Adjustable Frequency Drives

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Adjustable Frequency Drives

Contents



Model NFX9000

Product Description

Cutler-Hammer® NFX9000 adjustable frequency AC Drives from Eaton's electrical business are designed to provide adjustable speed control of three-phase motors. These microprocessor-based drives have standard features that can be programmed to tailor the drive's performance to suit a wide variety of application requirements.

The NFX9000 volts-per-hertz product line utilizes a 32-bit microprocessor and insulated gate bipolar transistors (IGBTs) which provide quiet motor operation, high motor efficiency and smooth low speed performance. The size and simplicity of the NFX9000 make it ideal for hassle free installation where size is a primary concern.

Models rated at 240 volts, single- or three-phase, 50/60 Hz are available in sizes ranging from 1/4 to 2 hp. Models rated at 115 volts, single-phase, 50/60 Hz are available in the 1/4 to 1/2 hp size range.

The standard drive includes a digital display, operating and programming keys on the keypad.

The display provides drive monitoring as well as adjustment and diagnostic information. The keys are utilized for digital adjustment and programming of the drive as well as for operator control. Separate terminal blocks for control and power wiring are provided for customer connections. The drives feature RS-485 serial communications.

Features and Benefits

Table 40-1. Features and Benefits

Feature	Customer Benefit
V/Hz Control.	Provides 150% starting torque and advanced low speed control.
Clearly laid out and easy to understand keypad with 4-character LED display, 4 status indicating LEDs, speed potentiometer, and 5 function keys.	Most informative operator's interface in this class of VFD, provided as standard. All parameters, diagnostic information and metering values are displayed with a bright 4-character LED display.
1 analog input 4 programmable, intelligent digital inputs 1 programmable relay	Provide enhanced application flexibility.
Serial communication port (RS-485).	Direct connection to serial communications networks.
Single-phase or three-phase input capability on 115/240V AC rated units.	Operate three-phase motor with single-phase supply.

Technical Data and Specifications

Output Ratings

- Horsepower;
  - 90V – 132V, 1/4 – 1/2 hp
  - 200 – 240V: 1/2 – 2 hp
- Frequency Range: 0.1 – 400 Hz
- Overload Rating: 150% for 60 seconds
- Frequency Resolution:
  - Digital: 0.1 Hz
- Frequency Accuracy
  - Digital: ± 0.01% of max. frequency
  - Analog: ± 0.2% of max. frequency
- Undervoltage Carryover Limit: 0.3 to 25 seconds

Motor Performance

- Motor Control: V/Hz
- Constant Torque: Standard
- Speed Regulation: 0.5% of base speed

Input Power

- Voltage at 50/60 Hz ± 3 Hz
  - 100V – 120V, -10% +10% / 1-phase
  - 200V – 240V, -10% +5% / 1-phase
  - 200V – 240V, -10% +5% / 3-phase
- Displacement Power Factor: Better than 0.95
- Efficiency: Typically greater than 95%

Design Type

- Microprocessor: 32-Bit
- Converter Type: Diode
- Inverter Type: Insulated Gate Bipolar Transistor
- Waveform: PWM Volts/Hertz

Environment

- Operating Temperature:
  - -10°C to +40°C
- Humidity: 20 to 90% non-condensing
- Maximum Elevation: 1000 meters (3300 ft.)

Codes and Standards

- NEMA, IEEE, NEC: Design Standards
- UL Listed
- cUL Listed
- CE Marked

Enclosure

- Standard: Protected Chassis (IP20)

Protective Features

- Ground Fault: Standard
- Overload Protection: Standard
- Overcurrent: Standard
- Overvoltage: Standard
- Undervoltage: Standard
- Overtemperature: Standard
- Overload Limit: Standard

Set Up Adjustments, Performance Features, Operator Control and External Interface

Keypad

- Alphanumeric Display: Standard, 1 x 4 character
- Digital Indications: RUN/STOP and FORWARD/REVERSE
- Diagnostics: Last 3 trips with cause
- LED Status Indicators: 4 (RUN/STOP and FORWARD/ REVERSE)
- Operator Functions: RUN/STOP, Speed control (digital or potentiometer), RESET, MODE Keys and ENTER.

I/O Terminal Block

- Analog Inputs:
  - 1 Input: 0 – 10V DC, 4 – 20 mA
  - Potentiometer: 1K ohm to 2K ohm
  - Analog Voltage: Nominal 10V DC (10K ohm input impedance)
  - Analog Current: Nominal 4 – 20 mA (250 ohm)
- Digital Inputs: 4 Programmable Inputs
- Digital Outputs: 1 Form A Relay contact

Programmable Parameters

- Out of the Box: Factory settings loaded for quick start-up.
- Accel. and Decel.: 2 separately adjustable Linear or S Curve times: 0.1 – 600 seconds
- DC Injection Braking
- External Fault: Terminal input
- Jog: Terminal input
- Fault Reset: STOP/RESET or terminal input
- I/O: NO/NC Selectable
- Jump Frequencies: 3 (with adjustable width)
- Parameter Security: Programmable software lock
- Preset Speeds: 2 preset speeds
- Reversing: Keypad or terminal
- Speed Setting: Keypad, terminal or pot
- RUN/STOP Control: Keypad or terminal
- Stop Modes: Decel, coast or DC injection

Reliability

- Pretested Components: Standard
- Surface Mount Technology: Standard (PCBs)
- Computerized Testing: Standard
- Final Test with Full Load: Standard
- Eaton's Cutler-Hammer Engineering Systems and Service: National network of AF drive specialists

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Table 40-2. Watts Loss

Horsepower	Catalog Number	Volts	Watts Loss 9 kHz
1/4	**NFXF25A0-1**	115V AC	20W
1/2	**NFXF50A0-1**		20W
1/4	**NFXF25A0-2**	230V AC	20W
1/2	**NFXF50A0-2**		20W
1	**NFX001A0-2**		38W
2	**NFX002A0-2**		75W

Wiring Diagrams

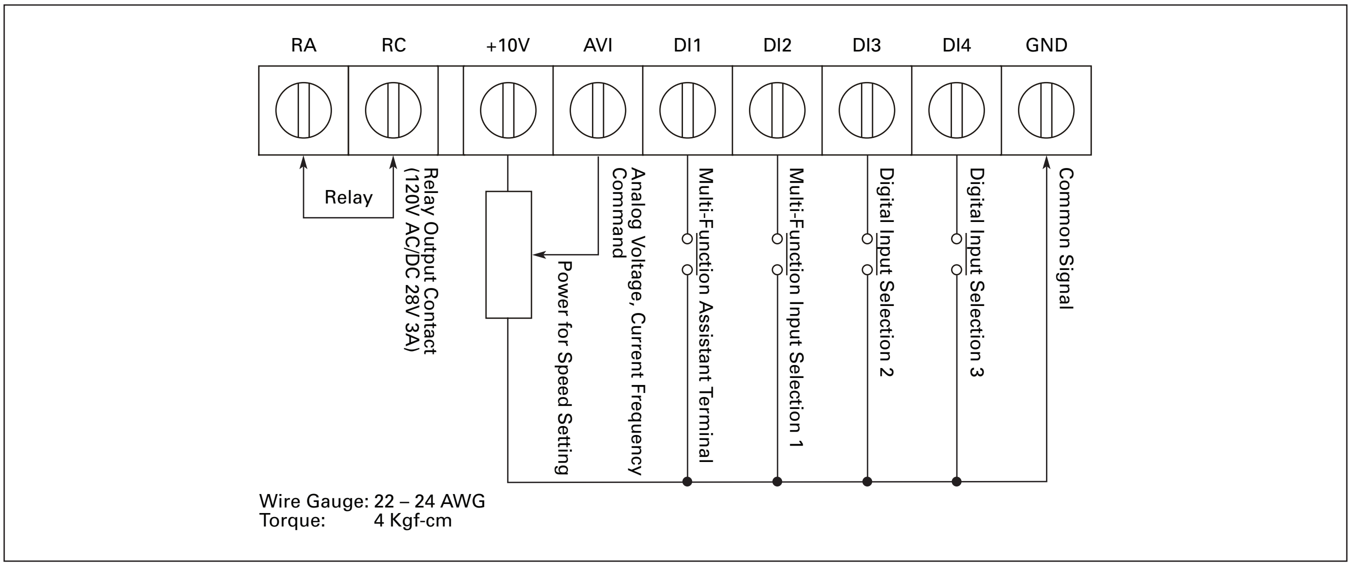


Figure 40-1. Control Terminal Wiring (Factory Settings)

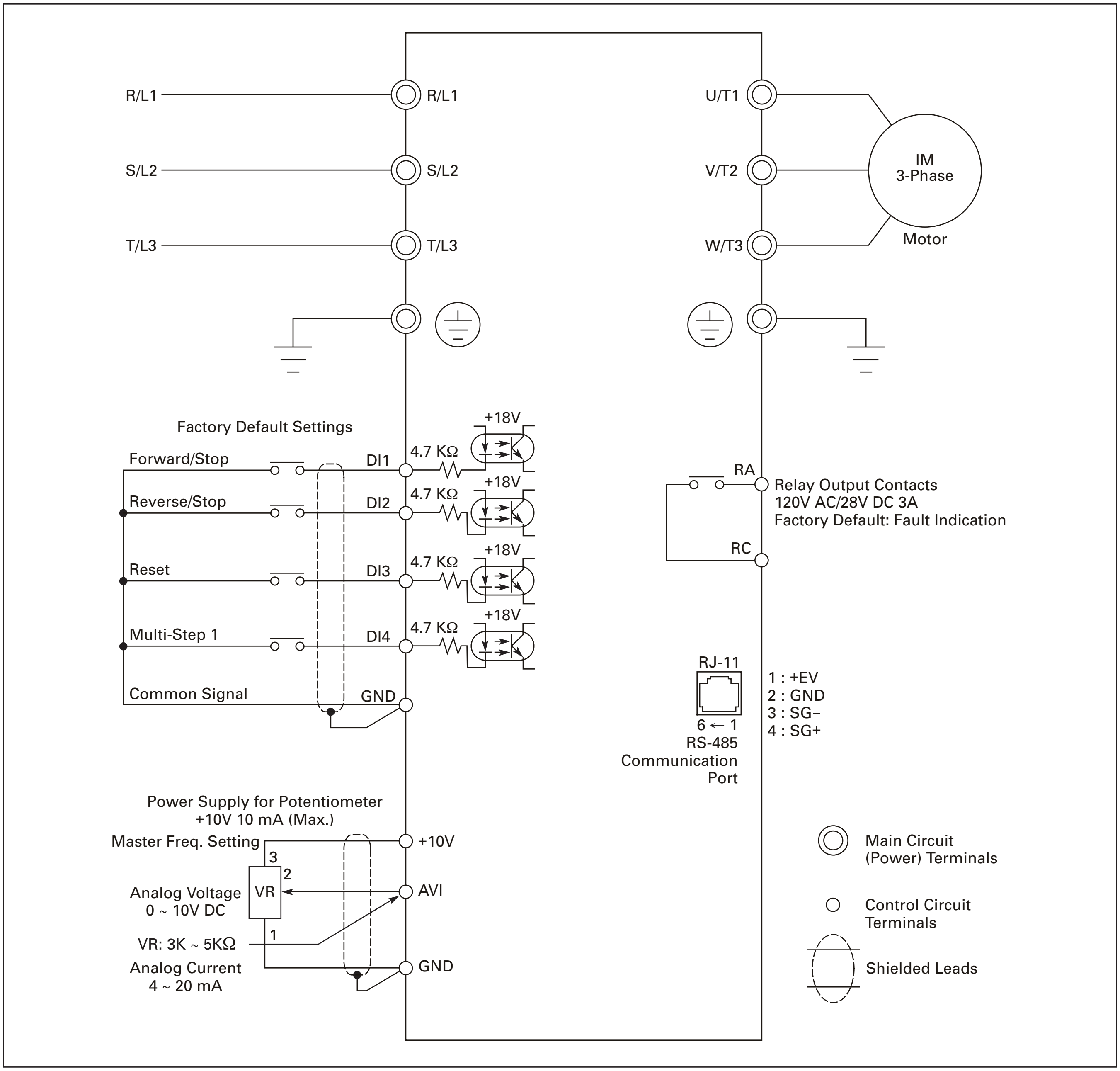


Figure 40-2. Basic Wiring Diagram

Note: Do not plug a modem or telephone line to the RS-485 communication port, permanent damage may result. Terminals 1 and 2 are the power sources for the optional copy keypad and should not be used while using RS-485 communication.

- Use power terminals R/L1 and S/L2 for single-phase connection to models: NFXF25A0-1, NFXF50A0-1, NFXF25A0-2, NFXF50A0-2 or NFX001A0-2.
- Use power terminals R/L1, S/L2 and T/L3 for three-phase connection to models: NFXF25A0-2, NFXF50A0-2, NFX001A0-2 or NFX002A0-2.
- Single-phase power must not be used for model NFX002A0-2.

Dimensions

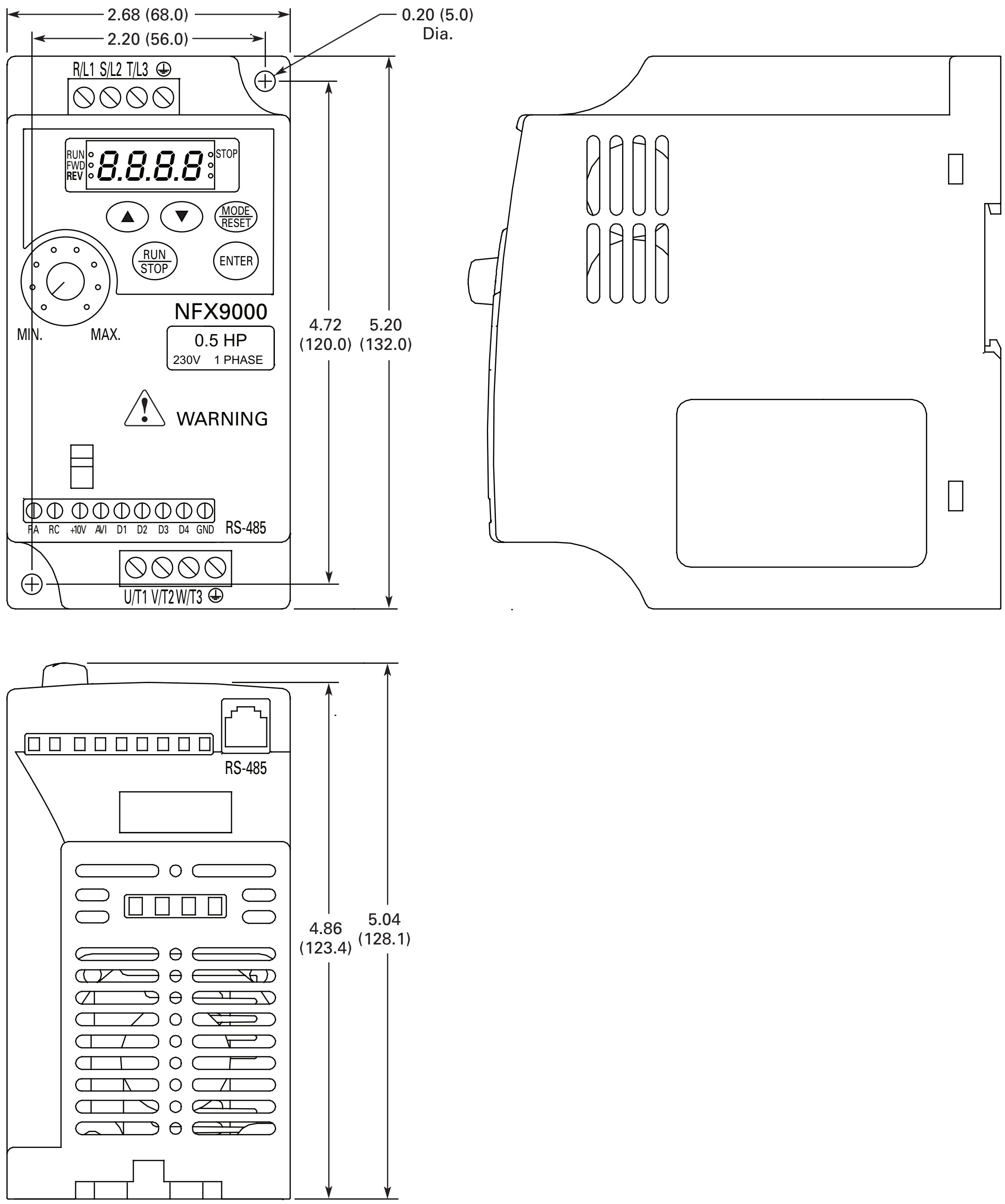


Figure 40-3. 1/4 to 2 hp Drive Approximate Dimensions in Inches (mm)

Catalog Number Selection

Table 40-3. NFX9000 Catalog Numbering System

N F X 0 0 1 A 0 - 2

Base Catalog Number: NFX

Horsepower
- **F25** = 1/4 hp
- **F50** = 1/2 hp
- **001** = 1 hp
- **002** = 2 hp

Series
- **A**

Enclosure
- **0** = IP20

Voltage
- **1** = 115V AC
- **2** = 240V AC

Product Selection

Table 40-4. NFX9000 Basic Controller IP20

Description		Input Ampere Single-/ Three-Phase Rating	Continuous Output Amp Rating	Catalog Number	Price U.S. $
hp ①	Volts ②				
1/4	90 – 130	6.0/—	1.6	**NFXF25A0-1**	
1/2		9.0/—	2.5	**NFXF50A0-1**	
1/4	200 – 240	4.9/—	1.6	**NFXF25A0-2**	
1/2		6.5/—	2.5	**NFXF50A0-2**	
1		9.7/—	4.2	**NFX001A0-2**	
2		—/9.0	7	**NFX002A0-2**	

① Horsepower ratings are based on the use of a 240V or 480V NEMA B, 4- or 6-pole squirrel cage induction motor and are for reference only. Units are to be selected such that the motor current is less than or equal to the NFX9000 rated continuous output current.

② For 208V, 380V or 415V applications, select the unit such that the motor current is less than or equal to the NFX9000 rated continuous output current.

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Discount Symbol **SS-1**

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Model MVX9000

Product Description

Cutler-Hammer® MVX9000 sensorless vector adjustable frequency AC Drives from Eaton's electrical business are designed to provide adjustable speed control of three-phase motors. These microprocessor-based, sensorless vector drives have standard features that can be programmed to tailor the drive's performance to suit a wide variety of application requirements.

The MVX9000 sensorless vector product line utilizes a 32-bit microprocessor and insulated gate bipolar transistors (IGBTs) which provide quiet motor operation, high motor efficiency and smooth low speed performance. The size and simplicity of the MVX9000 make it ideal for hassle free installation where size is a primary concern.

Models rated at 480 volts, three-phase, 50/60 Hz are available in sizes ranging from 1 to 10 hp. Models rated at 240 volts, single- or three-phase, 50/60 Hz are available in sizes ranging from 1/2 to 7-1/2 hp. Models rated at 115 volts, single-phase, 50/60 Hz are available in the 1/4 to 1 hp size range.

The standard drive includes a digital display, operating and programming keys on a removable keypad.

The display provides drive monitoring as well as adjustment and diagnostic information. The keys are utilized for digital adjustment and programming of the drive as well as for operator control. Separate terminal blocks for control and power wiring are provided for customer connections. Other features provided as standard include built-in DC braking, RS-485 serial communications and PID control.

Features and Benefits

Table 40-5. Features and Benefits

Feature	Customer Benefit
Sensorless Vector Control with auto tuning.	Provides 200% starting torque and advanced low speed torque control.
Clearly laid out and easy to understand keypad with 4-character LED display, 7 status indicating LEDs, speed potentiometer, and 6 function keys.	Most informative operator's interface in this class of VFD, provided as standard. All parameters, diagnostic information and metering values are displayed with a bright 4-character LED display.
2 analog inputs 6 programmable, intelligent digital inputs 1 programmable digital output 1 programmable relay	Provide enhanced application flexibility.
PID control of a process variable such as pressure, flow, temperature, liquid level, etc.	Eliminates requirement for separate setpoint controller.
Built-in dynamic braking chopper.	Superior deceleration performance.
Serial communication port (RS-485).	Direct connection to serial communications networks.
Single-phase or three-phase input capability on 240V AC rated units, 3 hp and below.	Operate three-phase motor with single-phase supply.

Technical Data and Specifications

Output Ratings

- Horsepower;
  - 90 – 132V, 1/4 – 1 hp
  - 200 – 240V: 1/2 – 7-1/2 hp
  - 380 – 480V: 1 – 10 hp
  - 425 – 660V: 1 – 10 hp
- Frequency Range: 0.1 – 400 Hz
- Overload Rating: 150% for 60 seconds
- Frequency Resolution:
  - Digital: 0.1 Hz
  - Analog: Max. (Set Frequency/1000) Hz
- Frequency Accuracy
  - Digital: ± 0.01% of max. frequency
  - Analog: ± 0.2% of max. frequency
- Undervoltage Carryover Limit: 0.3 to 25 seconds

Motor Performance

- Motor Control: Sensorless Vector
- Constant and Variable Torque: Standard
- Speed Regulation: 0.5% of base speed

Input Power

- Voltage at 50/60 Hz ± 3 Hz
  - 100V – 120V, -10% +10% / 1-phase
  - 200V – 240V, -10% +5% / 1-phase
  - 200V – 240V, -10% +5% / 3-phase
  - 380V – 480V, -10% +10% / 3-phase
  - 500V – 600V, -15% +10% / 3-phase
- Displacement Power Factor: Better than 0.95
- Efficiency: Typically greater than 95%

Design Type

- Microprocessor: 32-Bit
- Converter Type: Diode
- Inverter Type: Insulated Gate Bipolar Transistor
- Waveform: Sensorless Vector

Environment

- Operating Temperature:
  - -10°C to +50°C
  - -10°C to +40°C (above 7-1/2 hp)
- Humidity: 20 to 90% non-condensing
- Maximum Elevation: 1000 meters (3300 ft.)

Codes and Standards

- NEMA, IEEE, NEC: Design Standards
- UL Listed
- cUL Listed
- CE Marked (Requires EMI filter)

Enclosure

- Standard: Protected Chassis (IP20)

Protective Features

- Ground Fault: Standard
- Overload Protection: Standard
- Overcurrent: Standard
- Overvoltage: Standard
- Undervoltage: Standard
- Overtemperature: Standard
- Overload Limit: Standard

Set Up Adjustments, Performance Features, Operator Control and External Interface

Keypad

- Alphanumeric Display: Standard, 1 x 4 character
- Digital Indications: Frequency (Hz), Motor Current (amps), User-Defined RUN/STOP, FORWARD/REVERSE and Parameters
- Diagnostics: Last 3 trips with cause
- LED Status Indicators: 8 (RUN/STOP, FORWARD/REVERSE, Hz, Amps, User Defined, and Input Speed)
- Operator Functions: START/STOP, Speed control (digital or potentiometer), RESET, SETUP Keys and ENTER.

I/O Terminal Block

- Analog Inputs:
  - 2 Inputs: 0 – 10V DC, 4 – 20 mA
  - Potentiometer: 1K ohm to 2K ohm
  - Analog Voltage: Nominal 10V DC (10K ohm input impedance)
  - Analog Current: Nominal 4 – 20 mA (250 ohm)
- Digital Inputs: 6 Programmable Inputs
- Digital Outputs: 1 Programmable Open collector and 1 Form C Relay contact
- Analog Monitor Output:
  - Analog meter – frequency or output current
- Dynamic Brake Chopper

Programmable Parameters

- Out of the Box: Factory settings loaded for quick start-up.
- Accel. and Decel.: 2 separately adjustable Linear or S Curve times: 0.1 – 3000 seconds
- Auto Restart: Overcurrent, overvoltage and undervoltage with 4 selectable retry restart modes
- DC Injection Braking
- External Fault: Terminal input
- Jog: Terminal input
- Fault Reset: STOP/RESET or terminal input
- I/O: NO/NC Selectable
- Jump Frequencies: 3 (with adjustable width)
- Parameter Security: Programmable software lock
- Preset Speeds: 7 preset speeds
- PID Controller: PID process control
- Reversing: Keypad or terminal
- Speed Setting: Keypad, terminal or pot
- START/STOP Control: Keypad or terminal
- Stop Modes: Decel, coast or DC injection

Reliability

- Pretested Components: Standard
- Surface Mount Technology: Standard (PCBs)
- Computerized Testing: Standard
- Final Test with Full Load: Standard
- Eaton's Cutler-Hammer Engineering Systems and Service: National network of AF drive specialists

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Table 40-6. Heat Loss Data

Model	Watts Lost at 9 kHz	Model	Watts Lost at 9 kHz	Watts Lost at 6 kHz
MVXF25A0-1 (1-phase)	20	MVX001A0-4	38	—
MVXF50A0-1 (1-phase)	20	MVX002A0-4	75	—
MVX001A0-1 (1-phase)	38	MVX003A0-4	110	—
MVXF50A0-2 (1-phase)	20	MVX005A0-4	185	—
MVXF50A0-2 (3-phase)	20	MVX007A0-4	275	—
MVX001A0-2 (1-phase)	38	MVX010A0-4	375	—
MVX001A0-2 (3-phase)	38	MVX001A0-5	—	30
MVX002A0-2 (1-phase)	75	MVX002A0-5	—	58
MVX002A0-2 (3-phase)	75	MVX003A0-5	—	83
MVX003A0-2 (1-phase)	110	MVX005A0-5	—	132
MVX003A0-2 (3-phase)	110	MVX007A0-5	—	191
MVX005A0-2	185	MVX010A0-5	—	211
MVX007A0-2	275	—	—	—

Table 40-7. All Braking Resistors & Braking Units Used in AC Drives

Applicable Motor hp	Applicable Motor kW	Braking Resistor Kit P/N	Qty of Resistors in Kit & Wiring	Total Resistance and Wattage applied to MVX	Full Load Torque (kgf-m) of System	Braking Torque @ 10%ED with Kit
115V Series						
1/4	.20	K13-000034-0821	1	80W 200Ω	.108	220%
1/2	.37	K13-000034-0821	1	80W 200Ω	.216	220%
1	.75	K13-000034-0821	1	80W 200Ω	.427	125%
230V Series						
1/2	.37	K13-000034-0821	1	80W 200Ω	.216	220%
1	.75	K13-000034-0821	1	80W 200Ω	.427	125%
2	1.5	K13-000034-0824	1	300W 70Ω	.849	125%
3	2.2	K13-000034-0824	1	300W 70Ω	1.262	125%
5	3.7	K13-000034-0825	1	400W 40Ω	2.080	125%
7-1/2	5.5	K13-000034-0826	2 in Parallel	500W 30Ω	3.111	125%
480V Series						
1	.75	K13-000034-0841	1	80W 750Ω	.427	125%
2	1.5	K13-000034-0843	1	300W 250Ω	.849	125%
3	2.2	K13-000034-0843	1	300W 250Ω	1.262	125%
5	3.7	K13-000034-0844	1	400W 150Ω	2.080	125%
7-1/2	5.5	K13-000034-0845	2 in Parallel	500W 100Ω	3.111	125%
10	7.5	K13-000034-0846	3 in Parallel	1000W 75Ω	4.148	125%
575V Series						
1	.75	K13-000034-0851	1	300W 400Ω	.427	125%
2	1.5	K13-000034-0851	1	300W 400Ω	.849	125%
3	2.2	K13-000034-0852	—	600W 200Ω	1.262	125%
5	3.7	K13-000034-0852	—	600W 200Ω	2.080	125%
7-1/2	5.5	K13-000034-0852	—	600W 200Ω	3.111	125%
10	7.5	K13-000034-0853	—	2000W 100Ω	4.148	125%

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Wiring Diagrams

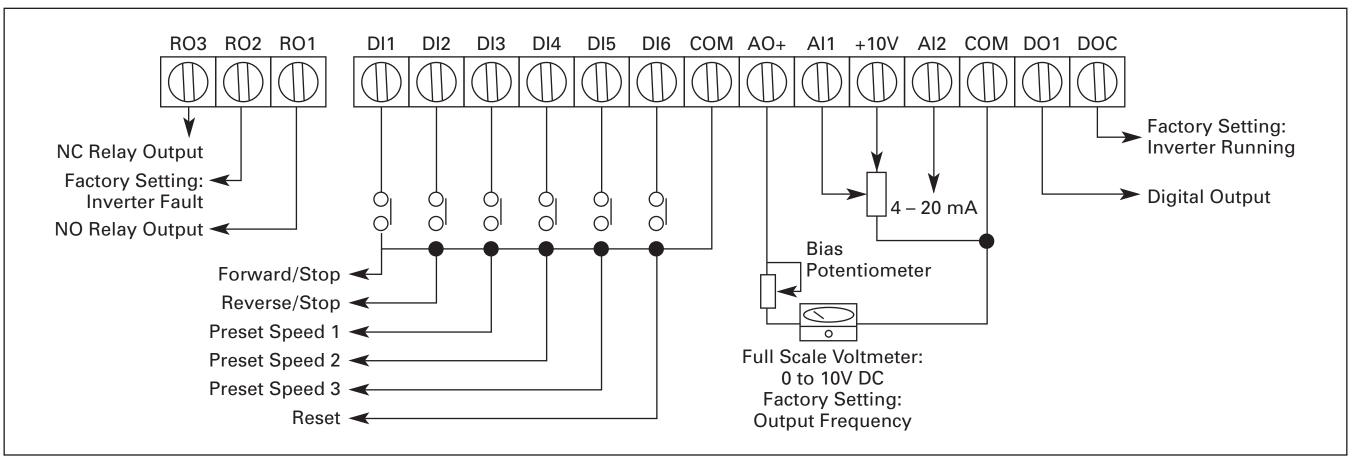


Figure 40-4. Control Terminal Wiring (Factory Settings)

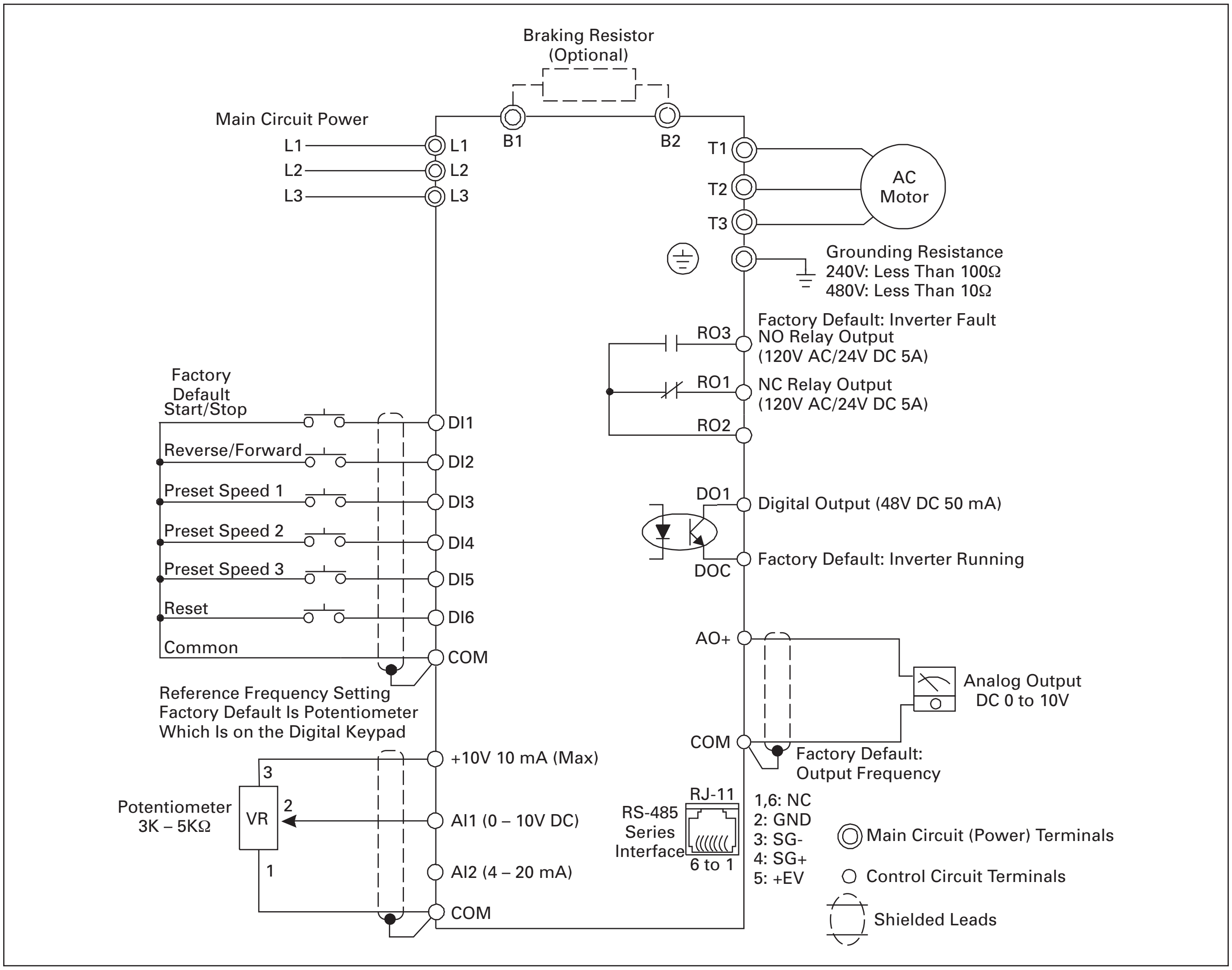


Figure 40-5. Basic Wiring Diagram

Note: Do not plug a modem or telephone line to the RS-485 communication port, permanent damage may result. Terminals 2 and 5 are the power sources for the optional copy keypad and should not be used while using RS-485 communication.

■ For single-phase application select correct model, and select any of the two input terminals for main circuit power.

Dimensions

Table 40-8. Approximate Dimensions and Shipping Weights for Basic Controller

Description		Dimensions in Inches (mm)			Shipping Weight Lbs. (kg)
Horsepower	Volts	Width	Height	Depth	
1/4	100 – 120	3.9 (100)	5.9 (151)	5.7 (145)	6.2 (2.8)
1/2		3.9 (100)	5.9 (151)	5.7 (145)	6.2 (2.8)
1		3.9 (100)	5.9 (151)	5.7 (145)	6.2 (2.8)
1/2	200 – 240	3.9 (100)	5.9 (151)	5.7 (145)	6.2 (2.8)
1		3.9 (100)	5.9 (151)	5.7 (145)	6.2 (2.8)
2		3.9 (100)	5.9 (151)	5.7 (145)	6.2 (2.8)
3		4.9 (100)	8.6 (220)	7.6 (193)	12.1 (5.5)
5		4.9 (125)	8.6 (220)	7.6 (193)	12.1 (5.5)
7-1/2		4.9 (125)	8.6 (220)	7.6 (193)	12.1 (5.5)
1	380 – 480	3.9 (100)	5.9 (151)	5.7 (145)	6.2 (2.8)
2		3.9 (100)	5.9 (151)	5.7 (145)	6.2 (2.8)
3		3.9 (100)	5.9 (151)	5.7 (145)	6.2 (2.8)
5		4.9 (125)	8.6 (220)	7.6 (193)	12.1 (5.5)
7-1/2		4.9 (125)	8.6 (220)	7.6 (193)	12.1 (5.5)
10		4.9 (125)	8.6 (220)	7.6 (193)	12.1 (5.5)
1	500 – 600	3.9 (100)	5.9 (151)	5.7 (145)	6.2 (2.8)
2		3.9 (100)	5.9 (151)	5.7 (145)	6.2 (2.8)
3		3.9 (100)	5.9 (151)	5.7 (145)	6.2 (2.8)
5		4.9 (125)	8.6 (220)	7.6 (193)	12.1 (5.5)
7-1/2		4.9 (125)	8.6 (220)	7.6 (193)	12.1 (5.5)
10		4.9 (125)	8.6 (220)	7.6 (193)	12.1 (5.5)

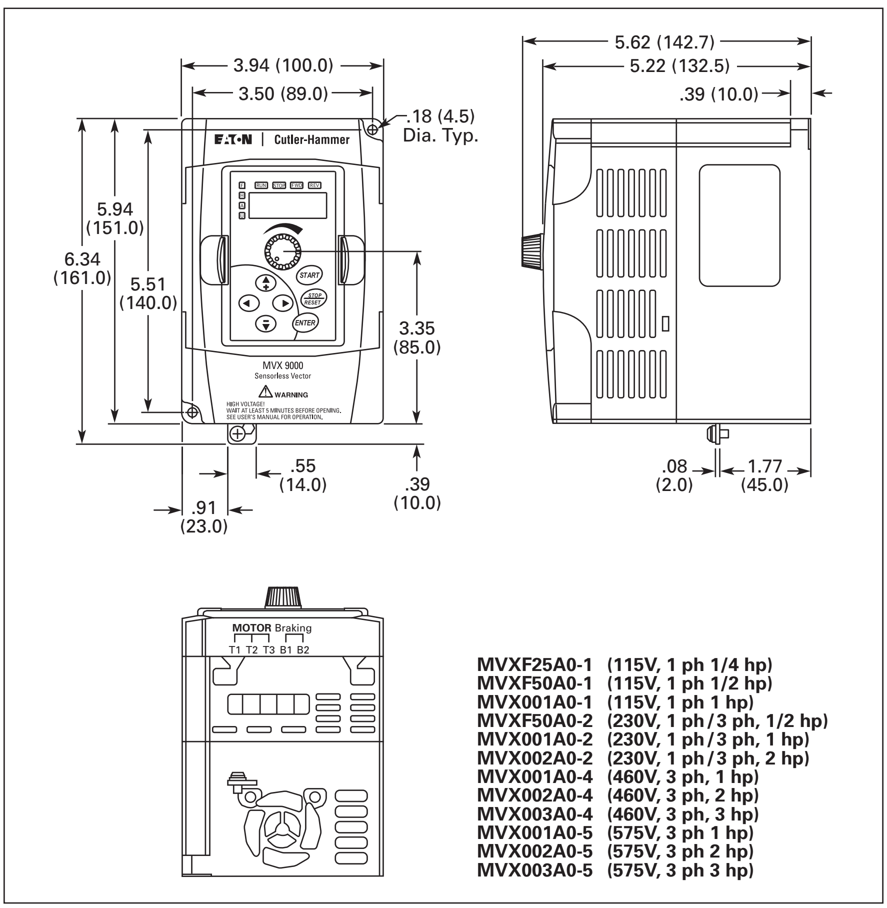


Figure 40-6. 1/4 to 3 hp Drive Approximate Dimensions in Inches (mm)

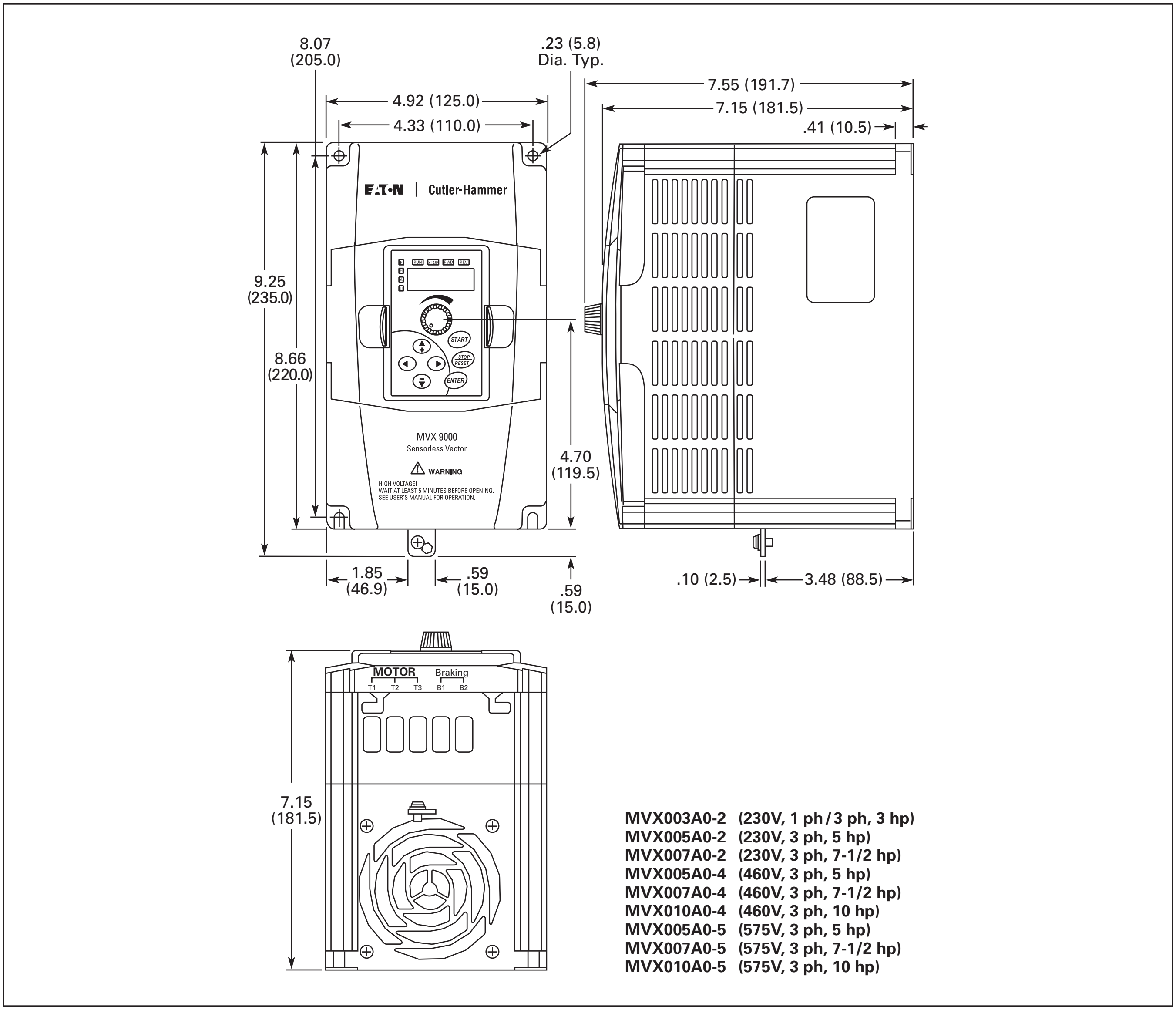


Figure 40-7. 3 to 10 hp Drive Approximate Dimensions in Inches (mm)

Open Drives

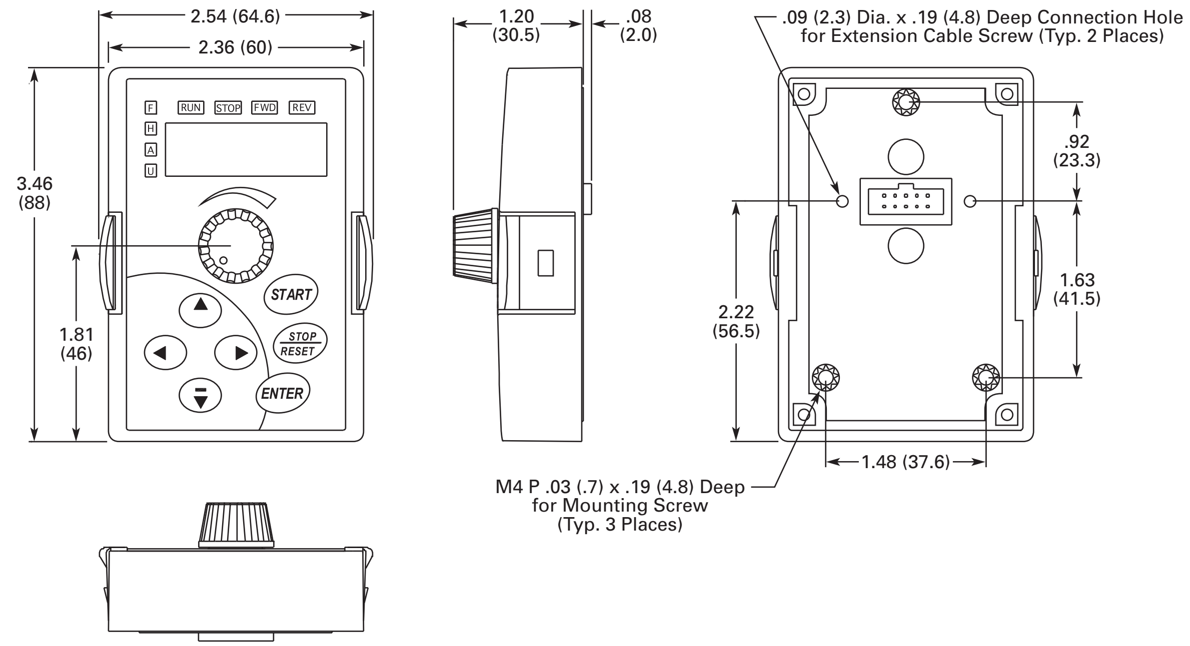
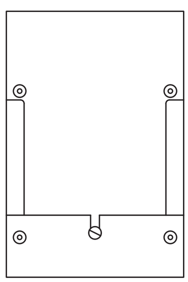


Figure 40-8. Digital Keypad Approximate Dimensions in Inches (mm)



Enclosure Frame	Approximate Dimensions in Inches (mm)					
	H	W	D	H1	H2	W1
MVXENCS	9.7 (246.4)	4.2 (106.7)	5.7 (144.8)	8.2 (208.3)	.8 (20.3)	2.1 (53.3)
MVXENCL	12.8 (325.1)	5.2 (132.1)	7.4 (188.0)	11.0 (279.4)	1.0 (25.4)	2.6 (66.0)

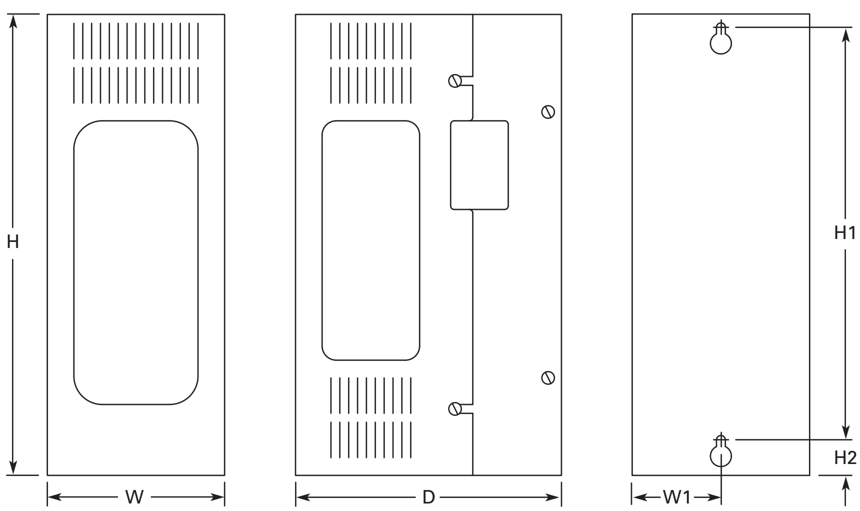


Figure 40-9. MVX9000 NEMA 1 Enclosure

Catalog Number Selection

Table 40-9. MVX9000 Catalog Numbering System

M V X 0 0 1 A 0 - 2

Base Catalog Number

Horsepower
- **F25** = 1/4 hp
- **F50** = 1/2 hp
- **001** = 1 hp
- **002** = 2 hp
- **003** = 3 hp
- **005** = 5 hp
- **007** = 7-1/2 hp
- **010** = 10 hp

Series
- **A**

Enclosure
- **0** = IP20

Voltage
- **1** = 115V AC
- **2** = 240V AC
- **4** = 480V AC
- **5** = 575V AC

Product Selection

Table 40-10. MVX9000 Basic Controller IP20

Description Hp ①	Volts ②	Input Amp. Single-/ 3-Phase Rating	Continuous Output Amp Rating	Catalog Number	Price U.S. $
1/4	90 – 130	6.3/—	1.6	**MVXF25A0-1**	
1/2		9.0/—	2.5	**MVXF50A0-1**	
1		18.0/—	4.2	**MVX001A0-1**	
1/2	200 – 240	6.3/2.9	2.5	**MVXF50A0-2**	
1		11.5/6.3	5.0	**MVX001A0-2**	
2		15.7/8.8	7.0	**MVX002A0-2**	
3		27.5/12.5	10	**MVX003A0-2**	
5		—/19.6	17	**MVX005A0-2**	
7-1/2		—/31.5	25	**MVX007A0-2**	
1	380 – 480	—/4.2	3.0	**MVX001A0-4**	
2		—/5.7	4.0	**MVX002A0-4**	
3		—/7.0	5.0	**MVX003A0-4**	
5		—/8.5	8.2	**MVX005A0-4**	
7-1/2		—/14	13	**MVX007A0-4**	
10		—/20.6	18	**MVX010A0-4**	
1	500 – 600	—/2.4	1.7	**MVX001A0-5**	
2		—/4.2	3.0	**MVX002A0-5**	
3		—/5.9	4.2	**MVX003A0-5**	
5		—/7.0	6.6	**MVX005A0-5**	
7-1/2		—/10.5	9.9	**MVX007A0-5**	
10		—/12.9	12.2	**MVX010A0-5**	

① Horsepower ratings are based on the use of a 240V or 480V NEMA B, 4- or 6-pole squirrel cage induction motor and are for reference only. Units are to be selected such that the motor current is less than or equal to the MVX9000 rated continuous output current.

② For 208V, 380V or 415V applications, select the unit such that the motor current is less than or equal to the MVX9000 rated continuous output current.

Options

Table 40-11. Field Options Kits

Description	Catalog Number	Price U.S. $
Keypads		
Copy Keypad	**MVXCOPY**	
Normal Keypad	**MVXKPD**	
Remote Kit	**MVXRM**	
Miscellaneous Options		
Extension I/O	**MVXEIO**	
DIN Rail	**MVXDR**	
Communications		
DeviceNet Module	**MVXDN**	
NEMA 1 Enclosure		
Small Frame	**MVXENCS**	
Large Frame	**MVXENCL**	
3% Line Reactor, 1-phase		
1/2 hp, 240V	**K64-000988-8091**	
1 hp, 240V	**K64-000988-0120**	
2 hp, 240V	**K64-000988-0180**	
3 hp, 240V	**K64-000988-0250**	
3% Line Reactor, 3-phase		
1 hp, 480V	**K64-000989-2091**	
2 hp, 480V	**K64-000989-4091**	
3 hp, 480V	**K64-000989-4091**	
5 hp, 480V	**K64-000989-8091**	
7-1/2 hp, 480V	**K64-000989-0180**	
10 hp, 480V	**K64-000989-0250**	
1/2 hp, 240V	**K64-000988-2091**	
1 hp, 240V	**K64-000988-4091**	
2 hp, 240V	**K64-000988-8091**	
3 hp, 240V	**K64-000988-0120**	
5 hp, 240V	**K64-000988-0180**	
7-1/2 hp, 240V	**K64-000988-0250**	
Output Line Reactor		
1 hp, 480V	**K64-000989-2091**	
2 hp, 480V	**K64-000989-4091**	
3 hp, 480V	**K64-000989-4091**	
5 hp, 480V	**K64-000989-8091**	
7-1/2 hp, 480V	**K64-000989-0120**	
10 hp, 480V	**K64-000989-0180**	
EMI Filter		
1/2 hp, 240V AC, Single-Phase	**K13-000034-0111**	
1 hp, 240V AC, Single-Phase	**K13-000034-0111**	
2 hp, 240V AC, Single-Phase	**K13-000034-0111**	
3 hp, 240V AC, Single-Phase	**K13-000034-0112**	
1/2 hp, 240V AC, Three-Phase	**K13-000034-0113**	
1 hp, 240V AC, Three-Phase	**K13-000034-0113**	
2 hp, 240V AC, Three-Phase	**K13-000034-0113**	
3 hp, 240V AC, Three-Phase	**K13-000034-0113**	
5 hp, 240V AC, Three-Phase	**K13-000034-0115**	
7-1/2 hp, 240V AC, Three-Phase	**K13-000034-0115**	
1 hp, 480V AC, Three-Phase	**K13-000034-0114**	
2 hp, 480V AC, Three-Phase	**K13-000034-0114**	
3 hp, 480V AC, Three-Phase	**K13-000034-0114**	
5 hp, 480V AC, Three-Phase	**K13-000034-0116**	
7-1/2 hp, 480V AC, Three-Phase	**K13-000034-0116**	
10 hp, 480V AC, Three-Phase	**K13-000034-0117**	
Dynamic Braking Resistor		
1/2 – 1 hp, 240V	**K13-000034-0821**	
2 – 3 hp, 240V	**K13-000034-0824**	
5 hp, 240V	**K13-000034-0825**	
7-1/2 hp, 240V	**K13-000034-0826**	
1 hp, 480V	**K13-000034-0841**	
2 – 3 hp, 480V	**K13-000034-0843**	
5 hp, 480V	**K13-000034-0844**	
7-1/2 hp, 480V	**K13-000034-0845**	
10 hp, 480V	**K13-000034-0846**	

Discount Symbol **SS-1**

Contents



MVX Drive with 3-Contactor Bypass

Product Description

Eaton's Cutler-Hammer® MVX9000 is offered in a variety of enclosure options to provide protection for operator and equipment. Enclosure ratings include Type 1, 12, 3R and 4X. (Enclosure ratings are defined in **PG03300001E**.)

Model MVX9000 sensorless vector adjustable frequency AC drives are designed to provide adjustable speed control of three-phase motors. These microprocessor-based, sensorless vector drives have standard features that can be programmed to tailor the drive's performance to suit a wide variety of application requirements.

The MVX9000 sensorless vector product line utilizes a 32-bit microprocessor and insulated gate bipolar transistors (IGBTs) which provide quiet motor operation, high motor efficiency and smooth low speed performance. The size and simplicity of the MVX9000 make it ideal for hassle free installations where size is a primary concern.

Models rated at 575 and 480 volts, 3-phase, 50/60 Hz are available in sizes ranging from 1 to 10 hp. Models rated at 240 volts, single- or 3-phase, 50/60 Hz are available in sizes ranging from 1/2 to7-1/2 hp.

The standard drive includes a digital display, operating and programming keys on a removable keypad. The display provides drive monitoring as well as adjustment and diagnostic information. The keys are utilized for digital adjustment and programming of the drive as well as for operator control. Separate terminal blocks for control and power wiring are provided for customer connections. Other features provided as standard include built-in DC braking, RS-485 serial communications and PID control.

The enclosed microdrives can be configured with standard modification codes including options for various cover controls, two- and three-contactor bypass, communications and traditional disconnect switch offerings.



Type 1/3R with Keypad Cover

Type 1 Enclosure

The Type 1 version of the MVX9000 sensorless vector product line utilizes a door-mountable (option) keypad. The keypad, with digital display, can be used for operating and programming the MVX9000 drive. Type 1 enclosed MVX9000s offer a standard gasketed cover in a ventilated enclosure.

Type 12 Enclosure

The Type 12 design uses a seam welded, dust-tight enclosure. These enclosures use the latest advances in cooling technology to offer space saving designs as well as providing ample space for modifications.



Type 12 Design

Type 3R Enclosure

The Type 3R design incorporates the MVX9000 technology into a compact, rainproof enclosure. Type 3R enclosures are available with a door mount keypad option utilizing a steel flange door to protect the keypad.

Type 4X Enclosure

The Type 4X enclosed MVX utilizes a seam-welded stainless steel enclosure. These enclosures use the latest advances in cooling technology to offer space saving designs as well as providing ample space for modifications.

Features

- **Drive Keypad Access** — Through-the-door access to STOP/START, speed potentiometer drive keys and programming available as an option on Type 1, 3R and 12
- Available as non-combination or combination with fusible or circuit breaker disconnect
- **Fusible Disconnect** — 30A or 60A with Class CC / J fuses or R fuses
- **Circuit Breaker** — Thermal magnetic circuit breaker with trip rating based on maximum drive FLA
- **Operating Mechanism** — Rotary or flange type with provisions for padlocking in the OFF position. An interlock defeater is built into the operating mechanism to permit the cover to be opened with the disconnect on
- **Cover Control** — Control devices available installed or in field assembly kits
- **Options** — Bus Choke, Bypass/Isolation Contactors, EMI Filter, Line Reactors, DeviceNet Interface and more

The compact design allows the controller to be located adjacent to the motor.

Standards and Certifications

Note: See Enclosed Control Product Guide PG03300001E for additional information on Standards and Certifications that apply to all Cutler-Hammer Enclosed Control products.

- UL Listed
- cUL Listed (indicates appropriate CSA Standard investigation)
- ABS Type Approval
- CE Mark available (Requires EMI filter)

Catalog Number Selection

Table 40-12. Enclosed Microdrive Catalog Numberingle System

E C S 80 B 1 B A A

Design
S = Solid-State

Class	Page
80 = Non-combination	**40-23**
81 = Disconnect Switch Combination	**40-24**
82 = Motor Circuit Protector Combination	**40-25**

Frame (hp)	
B = 1/2 ①	**F** = 5
C = 1	**G** = 7-1/2
D = 2	**H** = 10 ②
E = 3	

Enclosure Type
1 = 1 — General Purpose
2 = 3R — Rainproof
3 = 4 — Painted Steel
4 = 4X — 304-Grade Stainless Steel
8 = 12 — Dust-Tight
9 = 4X — 316-Grade Stainless Steel

Voltage
B = 208 – 240V
C = 380 – 480V
D = 575V

Cover Control
See **Page 40-19**

Disconnect Rating Fuse Clips	
A = None	**E** = 60 Amp
C = 30 Amp	
Circuit Breaker Rating	
A = 15 Amp	**E** = 40 Amp
B = 20 Amp	**F** = 50 Amp
D = 30 Amp	

① Frame (hp) only available at 208 – 240V.
② Frame (hp) only available at 380 – 480V.

Cover Control

Table 40-13. MVX Non-reversing Pilot Devices

Description	Factory Installed	Type 1, 3R Kits for Field Installation	Type 12, 4X Kits for Field Installation
	Position 9 Alpha	Catalog Number	Catalog Number
None	A	—	—
START/STOP Pushbuttons	B	C400T21	C400T1
with Red RUN Pilot Light	C	C400T22 ①	—
with Red RUN/Green OFF Lights	D	C400T23 ①	—
ON/OFF Pushbuttons	E	—	C400T2
with Red RUN Pilot Light	F	—	—
with Red RUN/Green OFF Lights	G	—	—
HAND/OFF/AUTO Selector Switch	H	C400T24	C400T12
with Red RUN Pilot Light	J	C400T25 ①	—
with Red RUN/Green OFF Lights	K	C400T26 ①	—
Red RUN Pilot Light	L	C400T10 ①	C400T9 ①
Green OFF Pilot Light	M	C400T11 ①	C400T10 ①
Red RUN/Green OFF Pilot Lights	N	C400T12 ①	C400T11 ①
START/STOP Selector Switch	P	—	C400T13
with Red RUN Pilot Light	Q	—	—
with Red RUN/Green OFF Lights	R	—	—
Speed Potentiometer	S	—	—

① Add Code Letter from table below to Catalog Number for voltage — kits only. Example: C400T10**A**.

Rating	Code Letter	Rating	Code Letter	Rating	Code Letter
120V 60 Hz	A	240V 60 Hz	B	480V 60 Hz	C
208V 60 Hz	E	380V 50 Hz	L	600V 60 Hz	D

Table 40-14. MVX Reversing Pilot Devices

Description	Factory Installed	Type 1, 3R Kits for Field Installation	Type 12, 4X Kits for Field Installation
	Position 9 Alpha	Catalog Number	Catalog Number
None	A	—	—
FORWARD/REVERSE/STOP Pushbuttons	T	C400T50	C400T6
with 2 Red Pilot Lights	U	C400T51 ②	—
with 2 Red/1 Green Lights	V	C400T52 ②	—
UP/STOP/DOWN Pushbuttons	W	—	—
with 2 Red Pilot Lights	X	—	—
with 2 Red/1 Green Lights	Y	—	—
FORWARD/OFF/REVERSE Selector Switch	Z	C400T53	C400T15
with 2 Red Pilot Lights	1	C400T54 ②	—
with 2 Red/1 Green Lights	2	C400T55 ②	—
2 Red Pilot Lights	3	—	③
Green OFF Pilot Light	4	C400T11 ②	C400T10 ②
2 Red/1 Green Pilot Lights	5	—	—
Speed Potentiometer	S	—	—

② Add Code Letter from table below to Catalog Number for voltage — kits only. Example: C400T10**A**.

Rating	Code Letter	Rating	Code Letter	Rating	Code Letter
120V 60 Hz	A	240V 60 Hz	B	480V 60 Hz	C
208V 60 Hz	E	380V 50 Hz	L	600V 60 Hz	D

③ Order 2 C400T9 ②.

Modification Codes

Table 40-15. A — Auxiliary Contacts (when bypass contactor chosen)

Modification	Catalog Number Suffix	Description
Top Mounted Auxiliary Contacts (Unwired) ①	**A13**	1NO
	A14	1NC
	A15	1NO-1NC
	A16	2NO
	A17	2NC
	A18	2NO-1NC
	A19	1NO-2NC
	A20	3NO
	A21	3NC
	A22	3NO-1NC
	A23	2NO-2NC
	A24	1NO-3NC
	A25	4NO
	A26	4NC

① For drive only run contacts, see Mods C12 and C14.

Table 40-16. B — Breaker Modifications, Bell Alarm, DC Bus Choke

Modification	Catalog Number Suffix	Description
Breaker	**B1**	1NO-1NC Auxiliary Contacts
	B2	2NO-2NC Auxiliary Contacts
	B3	Shunt Trip on Circuit Breaker — 48 – 127V AC or DC
Bell Alarm	**B16**	Bell Alarm for GHC
Bus Choke	**B20**	240V or 480V DC Bus Choke, Open Core and Coil ②

② A DC bus choke may be used in place of an AC line reactor for line harmonic current reduction and for power source exceeding 500 kVA. The DC bus choke will not provide any protection for line voltage unbalance or transients.

Table 40-17. C — Control Power Transformers, Control Relays, Control Sources, Bypass Contactors

Modification	Catalog Number Suffix	Description
Control Power Transformer	**C1**	Standard Size CPT, 120V/60 Hz, 110V/50 Hz Secondary with 2 Primary and 1 Secondary Fuse
	C42	50 VA Extra Capacity CPT, 120V/60 Hz, 110V/50 Hz Secondary with 2 Primary and 1 Secondary Fuse
	C3	100 VA Extra Capacity CPT, 120V/60 Hz, 110V/50 Hz Secondary with 2 Primary and 1 Secondary Fuse
	C5 ③	200 VA Extra Capacity CPT, 120V/60 Hz, 110V/50 Hz Secondary with 2 Primary and 1 Secondary Fuse
	C7 ③	300 VA Extra Capacity CPT, 120V/60 Hz, 110V/50 Hz Secondary with 2 Primary and 1 Secondary Fuse
	C8 ③	400 VA Extra Capacity CPT, 120V/60 Hz, 110V/50 Hz Secondary with 2 Primary and 1 Secondary Fuse
Control Relay ④	**C13**	RUN Relay, 24V DC
Separate Control	**C35**	Wired for Separate Control
	C45	Separate Source Disc (Type 1/12 fusible only)
Customer Supplied	**C36**	Customer Supplied Components to Be Installed
	C37	Customer Supplied Wiring Diagram to Use
Bypass Contactors ③	**C46/J1**	Isolation Contactor
	C46/J2	Output Contactor
	C46/J3	Bypass Contactor ⑤
	C46/J4	Isolation/Output/Bypass Contactors ⑤
	C46/J5	3 Contactor Bypass Package — Includes CPT, Pilot Lights, Selector Switch, Auxiliary Contacts and Control Relay ⑤

③ Requires oversize enclosure.
④ Provides additional contacts for drive run indication.
⑤ Includes bimetallic overload.

Table 40-18. D — Device Labels, DIN Rail

Modification	Catalog Number Suffix	Description
Device Labels	**D1**	Device Labels — Specify
DIN Rail	**D8**	DIN Rail Installed

Table 40-19. E — Enclosure Modifications, Elapsed Time Meter

Modification	Catalog Number Suffix	Description
Enclosure	**E3**	Oversized Enclosure
Elapsed Time Meter	**E9**	Type 1, 3R, 12, 4X

Table 40-20. F — Fuse Clips, Fuse Blocks, EMI Filter

Modification	Catalog Number Suffix	Description
Fuse Blocks	**F4**	Power Fuses Included — Order by Description
	F5	30A Control Circuit Fuseholder (KTK) Mounted on Panel (unwired) Fuse Not Supplied
	F6	30A Control Circuit Fuseholder Mounted on Panel (unwired), 5A KTK Fuse Supplied
EMI Filter ②	**F22**	240V or 480V 3-Phase ①
	F23	240V 1-Phase ①

① The EMI filter is not necessary to meet the CE mark requirements for EMC when installing the MVX in an EC country.
② Requires oversized enclosure.

Table 40-21. H — Space Heater, Heater Packs Installed

Modification	Catalog Number Suffix	Description			
Space Heater	**H1**	Space Heater and Thermostat			
	H2	Space Heater and NC Interlock (100 Watt)			
Install Heater Packs (Freedom Series) ③	**H5**	**Class 20**		**Class 10**	
		/D1	H2001B-3	/D25	H2101B-3
		/D2	H2002B-3	/D26	H2102B-3
		/D3	H2003B-3	/D27	H2103B-3
		/D4	H2004B-3	/D28	H2104B-3
		/D5	H2005B-3	/D29	H2105B-3
		/D6	H2006B-3	/D30	H2106B-3
		/D7	H2007B-3	/D31	H2107B-3
		/D8	H2008B-3	/D32	H2108B-3
		/D9	H2009B-3	/D33	H2109B-3
		/D10	H2010B-3	/D34	H2110B-3
		/D11	H2011B-3	/D35	H2111B-3
		/D12	H2012B-3	/D36	H2112B-3
		/D13	H2013B-3	/D37	H2113B-3
		/D14	H2014B-3	/D38	H2114B-3

③ Use only when C46 or R7 modifications are required.

Table 40-22. K — Keypad

Modification	Catalog Number Suffix	Description
Keypad	**K1**	Door-Mounted AFD Keypad (Type 1 and 12)
	K2	Door-Mounted AFD Keypad (Type 3R)
	K3	AFD Copy Keypad (mounted on drive)
	K4	Door-Mounted AFD Copy Keypad (Type 1 and 12)
	K5	Door-Mounted AFD Copy Keypad (Type 3R)

Table 40-23. L — Lightning Arrestor, Carton Label, Line Reactor, Load Reactor

Modification	Catalog Number Suffix	Description
Lightning Arrestor ④	**L1**	Lightning Arrestor
Label	**L10**	Carton Label — Customer Marking — Specify
Line Reactor (Type 1/12 design limited to either line or load reactor, not both)	**L12**	240V or 480V 3% Input Line Reactor, 3-Phase, Open Core and Coil ⑤
	L13	240V 3% Input Line Reactor, 1-Phase, Open Core and Coil ⑤
	L14	240V or 480V 5% Input Line Reactor, 3-Phase, Open Core and Coil ⑤
	L15	240V 5% Input Line Reactor, 1-Phase, Open Core and Coil ⑤
	L16	Line Reactor by Description
Output Line Filter (Type 1/12 design limited to either line or load reactor, not both)	**L17**	480V Output Line dv/dt Filter, Open Core and Coil ⑥
	L18	Load Reactor by Description

④ Requires oversized enclosure.
⑤ If the power source exceeds 500 kVA, 3% line unbalance, or if transient voltages from power factor capacitor switching events are present, an input line reactor must be used. The input line reactor will also reduce line current harmonics.
⑥ The output line dv/dt filter is required when the distance from the drive to the motor exceeds 33 feet (10.1m). The total cable run should not exceed 165 feet (50.3m).

Table 40-24. N — Nameplates

Modification	Catalog Number Suffix	Description
Nameplates	**N1**	Nameplate on Enclosure — Order Wording to Be Inscribed

Table 40-25. P — Pilot Lights, Pushbuttons, Phase Loss Relay, Phase Reversal Relay

Modification	Catalog Number Suffix	Description
Push-to-Test Pilot Lights	**P1**	Push-to-Test Pilot Light (Red RUN)
	P2	Push-to-Test Pilot Light (Green OFF)
	P3	Combination of **P1** and **P2** Above
	P4	Push-to-Test Pilot Light (Amber RUN)
	P54	Push-to-Test Pilot Light — Red BYPASS
	P55	Push-to-Test Pilot Light — Amber INVERTER ENABLE
	P56	Push-to-Test Pilot Light — Red INVERTER RUNNING
	P57	Push-to-Test Pilot Light — Green STOPPED
Pushbuttons	**P5**	EMERGENCY STOP — Mushroom Head
	P7	START/STOP
	P8	ON/OFF
	P9	START
	P10	ON
	P11	OFF
	P12	FORWARD/REVERSE/STOP
	P52	UP/STOP/DOWN
	P18	Pushbutton with Legend Plate (Order by Description)
Pilot Lights	**P19**	Amber Light “POWER AVAILABLE” Wired to Load Side of 2 Fuses or Circuit Breaker
	P20	Pilot Light (Amber) Wired to Coil
	P23	Pilot Light — Red RUN
	P24	Pilot Light — Red ON
	P25	Pilot Light — Green OFF
	P58	Pilot Light — Red BYPASS
	P59	Pilot Light — Amber INVERTER ENABLE
	P60	Pilot Light — Red INVERTER RUNNING
	P61	Pilot Light — Green STOP
	P26	Pilot Light (Order by Description)
Illuminated Pushbutton	**P27**	Illuminated Pushbutton (Order by Description)
Phase Loss Relay	**P28**	Phase Loss Relay
Phase Reversal Relay	**P30**	Phase Reversal Relay
Phase Unbalance Relay	**P32**	Phase Unbalance Relay
Phase Monitoring Relay	**P34**	Phase Monitoring Relay

Table 40-26. R — Relays, Overload Relay Modifications, DeviceNet™ Interface Mode

Modification	Catalog Number Suffix	Description
Relay	**R2**	Overvoltage Relay
	R7	Overload Relay (Order by Description)
Relay Modifications	**R45**	Auto Reset Only on Overload Relay
DeviceNet Interface Module	**R69**	DeviceNet Communication Interface

Table 40-27. S — Selector Switches, Suppressor, Surge Capacitor, Speed Pot

Modification	Catalog Number Suffix	Description
Selector Switches	**S3**	HAND-OFF-AUTO Selector Switch
	S10	OFF-AUTO Selector Switch
	S11	START-STOP Selector Switch
	S12	ON-OFF Selector Switch
	S16	FORWARD-REVERSE Selector Switch
	S38	INVERTER-OFF-BYPASS Selector Switch
	S40	Selector Switch (Order by Description)
Surge Capacitor	**S37**	Surge Capacitor Wired to Disconnect Line Side
Speed Pot	**S39**	Speed Potentiometer

Table 40-28. T — Timers, Terminal Blocks, Terminal Points, Ring Lug

Modification	Catalog Number Suffix	Description
Timers	**T3**	Pneumatic Timer Mounted in Enclosure, Unwired, 180 Seconds Maximum
	T4	Pneumatic Timer (Order by Description)
	T5	Solid-State Timer (Order by Description)
Terminal Blocks	**T9**	With 1 Single-Circuit Terminal Block, Unwired
	T10	With 2 Single-Circuit Terminal Blocks, Unwired
Terminal Points	**T11**	With 6 Terminal Points, Unwired
	T12	With 12 Terminal Points, Unwired
	T13	With 16 Terminal Points, Unwired
	T14	Terminal Point per Customer Specification, Unwired
	T15	Terminal Point per Customer Specification, Wired
Ring Lug	**T16**	Ring Lug Connections on Power Wires
	T17	Ring Lug Connections on Control Wires

Table 40-29. U — Undervoltage Relay

Modification	Catalog Number Suffix	Description
Undervoltage Relay	**U2**	Undervoltage Relay, Non-adjustable
Under and Over Relay	**U7**	Under and Overvoltage Relay

Table 40-30. W — Wiremarkers

Modification	Catalog Number Suffix	Description
Wiremarkers	**W7**	Wiremarkers

Product Selection

Table 40-31. Class ECS80 — Non-combination MVX9000 Drives

Volts	Input Amp. Single-/ 3-Phase Rating	Continuous Output Amp. Rating	Type 1 General Purpose		Type 3R Rainproof		Type 4X ① Watertight Stainless Steel		Type 12 Industrial Dust-Tight		Component Microdrive (Open)
			Catalog Number	Price U.S. $	Catalog Number	Price U.S. $	Catalog Number	Price U.S. $	Catalog Number	Price U.S. $	Catalog Number
1/2 hp											
208 – 240	5.8/3.4	2.5	**ECS80B1BAA**		**ECS80B2BAA**		**ECS80B4BAA**		**ECS80B8BAA**		**MVXF50A0-2**
1 hp											
208 – 240	9/5.2	5	**ECS80C1BAA**		**ECS80C2BAA**		**ECS80C4BAA**		**ECS80C8BAA**		**MVX001A0-2**
380 – 480	—/3.3	3	**ECS80C1CAA**		**ECS80C2CAA**		**ECS80C4CAA**		**ECS80C8CAA**		**MVX001A0-4**
500 – 600	—/2.4	1.7	**ECS80C1DAA**		**ECS80C2DAA**		**ECS80C4DAA**		**ECS80C8DAA**		**MVX001A0-5**
2 hp											
208 – 240	16/9.3	7	**ECS80D1BAA**		**ECS80D2BAA**		**ECS80D4BAA**		**ECS80D8BAA**		**MVX002A0-2**
380 – 480	—/5	4	**ECS80D1CAA**		**ECS80D2CAA**		**ECS80D4CAA**		**ECS80D8CAA**		**MVX002A0-4**
500 – 600	—/4.2	3	**ECS80D1DAA**		**ECS80D2DAA**		**ECS80D4DAA**		**ECS80D8DAA**		**MVX002A0-5**
3 hp											
208 – 240	22.5/13	10	**ECS80E1BAA**		**ECS80E2BAA**		**ECS80E4BAA**		**ECS80E8BAA**		**MVX003A0-2**
380 – 480	—/7	5	**ECS80E1CAA**		**ECS80E2CAA**		**ECS80E4CAA**		**ECS80E8CAA**		**MVX003A0-4**
500 – 600	—/5.9	4.2	**ECS80E1DAA**		**ECS80E2DAA**		**ECS80E4DAA**		**ECS80E8DAA**		**MVX003A0-5**
5 hp											
208 – 240	—/20	17	**ECS80F1BAA**		**ECS80F2BAA**		**ECS80F4BAA**		**ECS80F8BAA**		**MVX005A0-2**
380 – 480	—/11	8.2	**ECS80F1CAA**		**ECS80F2CAA**		**ECS80F4CAA**		**ECS80F8CAA**		**MVX005A0-4**
500 – 600	—/7.0	6.6	**ECS80F1DAA**		**ECS80F2DAA**		**ECS80F4DAA**		**ECS80F8DAA**		**MVX005A0-5**
7-1/2 hp											
208 – 240	—/31	25	**ECS80G1BAA**		**ECS80G2BAA**		**ECS80G4BAA**		**ECS80G8BAA**		**MVX007A0-2**
380 – 480	—/17	13	**ECS80G1CAA**		**ECS80G2CAA**		**ECS80G4CAA**		**ECS80G8CAA**		**MVX007A0-4**
500 – 600	—/10.5	9.9	**ECS80G1DAA**		**ECS80G2DAA**		**ECS80G4DAA**		**ECS80G8DAA**		**MVX007A0-5**
10 hp											
380 – 480	—/21	18	**ECS80H1CAA**		**ECS80H2CAA**		**ECS80H4CAA**		**ECS80H8CAA**		**MVX010A0-4**
500 – 600	—/12.9	12.2	**ECS80H1DAA**		**ECS80H2DAA**		**ECS80H4DAA**		**ECS80H8DAA**		**MVX010A0-5**

① These are the Catalog Numbers for Type 4X 304-Grade Stainless Steel, as indicated by the seventh digit **4**. Example: ECS80B**4**BAA-C1. To order Type 4X 316-Grade Stainless Steel, change that digit to **9**. To order Type 4 Painted Steel, change that digit to **3**. To order Nonmetallic, change that digit to **5**. For details on these Alternate Enclosures, see **PG03300001E**.

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Modifications . . . . **Pages 40-20 – 40-22**
Dimensions **PG03300001E**
Discount Symbol **SS-1**

Table 40-32. Class ECS81 — Combination Disconnect Switch MVX9000 Drives

Volts	Input Amp. Single-/ 3-Phase Rating	Continuous Output Amp. Rating	Fuse Clips	Type 1 General Purpose		Type 3R Rainproof		Type 4X ① Watertight Stainless Steel		Type 12 Industrial Dust-Tight		Component Microdrive (Open)
				Catalog Number	Price U.S. $	Catalog Number	Price U.S. $	Catalog Number	Price U.S. $	Catalog Number	Price U.S. $	Catalog Number
1/2 hp												
208 – 240	5.8/3.4	2.6	**30A**	**ECS81B1BAC**		**ECS81B2BAC**		**ECS81B4BAC**		**ECS81B8BAC**		**MVXF50A0-2**
1 hp												
208 – 240	9/5.2	4	**30A**	**ECS81C1BAC**		**ECS81C2BAC**		**ECS81C4BAC**		**ECS81C8BAC**		**MVX001A0-2**
380 – 480	—/3.3	2.5	**30A**	**ECS81C1CAC**		**ECS81C2CAC**		**ECS81C4CAC**		**ECS81C8CAC**		**MVX001A0-4**
500 – 600	—/2.4	1.7	**30A**	**ECS81C1DAC**		**ECS81C2DAC**		**ECS81C4DAC**		**ECS81C8DAC**		**MVX001A0-5**
2 hp												
208 – 240	16/9.3	7.1	**30A**	**ECS81D1BAC**		**ECS81D2BAC**		**ECS81D4BAC**		**ECS81D8BAC**		**MVX002A0-2**
380 – 480	—/5	3.8	**30A**	**ECS81D1CAC**		**ECS81D2CAC**		**ECS81D4CAC**		**ECS81D8CAC**		**MVX002A0-4**
500 – 600	—/4.2	3	**30A**	**ECS81D1DAC**		**ECS81D2DAC**		**ECS81D4DAC**		**ECS81D8DAC**		**MVX002A0-5**
3 hp												
208 – 240	22.5/13	10	**30A**	**ECS81E1BAC**		**ECS81E2BAC**		**ECS81E4BAC**		**ECS81E8BAC**		**MVX003A0-2**
380 – 480	—/7	5.5	**30A**	**ECS81E1CAC**		**ECS81E2CAC**		**ECS81E4CAC**		**ECS81E8CAC**		**MVX003A0-4**
500 – 600	—/5.9	4.2	**30A**	**ECS81E1DAC**		**ECS81E2DAC**		**ECS81E4DAC**		**ECS81E8DAC**		**MVX003A0-5**
5 hp												
208 – 240	—/20	15.9	**30A**	**ECS81F1BAC**		**ECS81F2BAC**		**ECS81F4BAC**		**ECS81F8BAC**		**MVX005A0-2**
380 – 480	—/11	8.6	**30A**	**ECS81F1CAC**		**ECS81F2CAC**		**ECS81F4CAC**		**ECS81F8CAC**		**MVX005A0-4**
500 – 600	—/7.0	6.6	**30A**	**ECS81F1DAC**		**ECS81F2DAC**		**ECS81F4DAC**		**ECS81F8DAC**		**MVX005A0-5**
7-1/2 hp												
208 – 240	—/31	24	**60A**	**ECS81G1BAE**		**ECS81G2BAE**		**ECS81G4BAE**		**ECS81G8BAE**		**MVX007A0-2**
380 – 480	—/17	13	**30A**	**ECS81G1CAC**		**ECS81G2CAC**		**ECS81G4CAC**		**ECS81G8CAC**		**MVX007A0-4**
500 – 600	—/10.5	9.9	**30A**	**ECS81G1DAC**		**ECS81G2DAC**		**ECS81G4DAC**		**ECS81G8DAC**		**MVX007A0-5**
10 hp												
380 – 480	—/21	16	**30A**	**ECS81H1CAC**		**ECS81H2CAC**		**ECS81H4CAC**		**ECS81H8CAC**		**MVX010A0-4**
500 – 600	—/12.9	12.2	**30A**	**ECS81H1DAC**		**ECS81H2DAC**		**ECS81H4DAC**		**ECS81H8DAC**		**MVX010A0-5**

① These are the Catalog Numbers for Type 4X 304-Grade Stainless Steel, as indicated by the seventh digit **4**. Example: ECS81B4BAC-C1. To order Type 4X 316-Grade Stainless Steel, change that digit to **9**. To order Type 4 Painted Steel, change that digit to **3**. To order Nonmetallic, change that digit to **5**. For details on these Alternate Enclosures, see **PG03300001E**.



Type 3R Combination HMCPE MVX Drive



Type 1 MXV Drive with Disconnect Switch and Bypass

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Dimensions **PG03300001E**
Discount Symbol **SS-1**

Table 40-33. Class ECS82 — Combination HMCPE Circuit Breaker MVX9000 Drives

Volts	Input Amp. Single-/ 3-Phase Rating	Continuous Output Amp. Rating	HMCP Rating Amps.	Type 1 General Purpose		Type 3R Rainproof		Type 4X ① Watertight Stainless Steel		Type 12 Industrial Dust-Tight		Component Microdrive (Open)
				Catalog Number	Price U.S. $	Catalog Number	Price U.S. $	Catalog Number	Price U.S. $	Catalog Number	Price U.S. $	Catalog Number
1/2 hp												
208 – 240	5.8/3.4	2.6	15	ECS82B1BAA		ECS82B2BAA		ECS82B4BAA		ECS82B8BAA		MVXF50A0-2
1 hp												
208 – 240	9/5.2	4	15	ECS82C1BAA		ECS82C2BAA		ECS82C4BAA		ECS82C8BAA		MVX001A0-2
380 – 480	—/3.3	2.5	15	ECS82C1CAA		ECS82C2CAA		ECS82C4CAA		ECS82C8CAA		MVX001A0-4
500 – 600	—/2.4	1.7	15	ECS82C1DAA		ECS82C2DAA		ECS82C4DAA		ECS82C8DAA		MVX001A0-5
2 hp												
208 – 240	16/9.3	7.1	15	ECS82D1BAA		ECS82D2BAA		ECS82D4BAA		ECS82D8BAA		MVX002A0-2
380 – 480	—/5	3.8	15	ECS82D1CAA		ECS82D2CAA		ECS82D4CAA		ECS82D8CAA		MVX002A0-4
500 – 600	—/4.2	3	15	ECS82D1DAA		ECS82D2DAA		ECS82D4DAA		ECS82D8DAA		MVX002A0-5
3 hp												
208 – 240	22.5/13	10	30	ECS82E1BAD		ECS82E2BAD		ECS82E4BAD		ECS82E8BAD		MVX003A0-2
380 – 480	—/7	5.5	15	ECS82E1CAA		ECS82E2CAA		ECS82E4CAA		ECS82E8CAA		MVX003A0-4
500 – 600	—/5.9	4.2	15	ECS82E1DAA		ECS82E2DAA		ECS82E4DAA		ECS82E8DAA		MVX003A0-5
5 hp												
208 – 240	—/20	15.9	30	ECS82F1BAD		ECS82F2BAD		ECS82F4BAD		ECS82F8BAD		MVX005A0-2
380 – 480	—/11	8.6	15	ECS82F1CAA		ECS82F2CAA		ECS82F4CAA		ECS82F8CAA		MVX005A0-4
500 – 600	—/7.0	6.6	15	ECS82F1DAA		ECS82F2DAA		ECS82F4DAA		ECS82F8DAA		MVX005A0-5
7-1/2 hp												
208 – 240	—/31	24	50	ECS82G1BAF		ECS82G2BAF		ECS82G4BAF		ECS82G8BAF		MVX007A0-2
380 – 480	—/17	13	30	ECS82G1CAD		ECS82G2CAD		ECS82G4CAD		ECS82G8CAD		MVX007A0-4
500 – 600	—/10.5	9.9	15	ECS82G1DAA		ECS82G2DAA		ECS82G4DAA		ECS82G8DAA		MVX007A0-5
10 hp												
380 – 480	—/21	16	30	ECS82H1CAD		ECS82H2CAD		ECS82H4CAD		ECS82H8CAD		MVX010A0-4
500 – 600	—/12.9	12.2	30	ECS82H1DAD		ECS82H2DAD		ECS82H4DAD		ECS82H8DAD		MVX010A0-5

① These are the Catalog Numbers for Type 4X 304-Grade Stainless Steel, as indicated by the seventh digit **4**. Example: ECS82B**4**BAA-C1. To order Type 4X 316-Grade Stainless Steel, change that digit to **9**. To order Type 4 Painted Steel, change that digit to **3**. To order Nonmetallic, change that digit to **5**. For details on these Alternate Enclosures, see **PG03300001E**.



Type 3R Combination HMCPE MVX Drive



Type 1 MXV Drive with Disconnect Switch and Bypass

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Dimensions **PG03300001E**
Discount Symbol **SS-1**

Wiring Diagrams

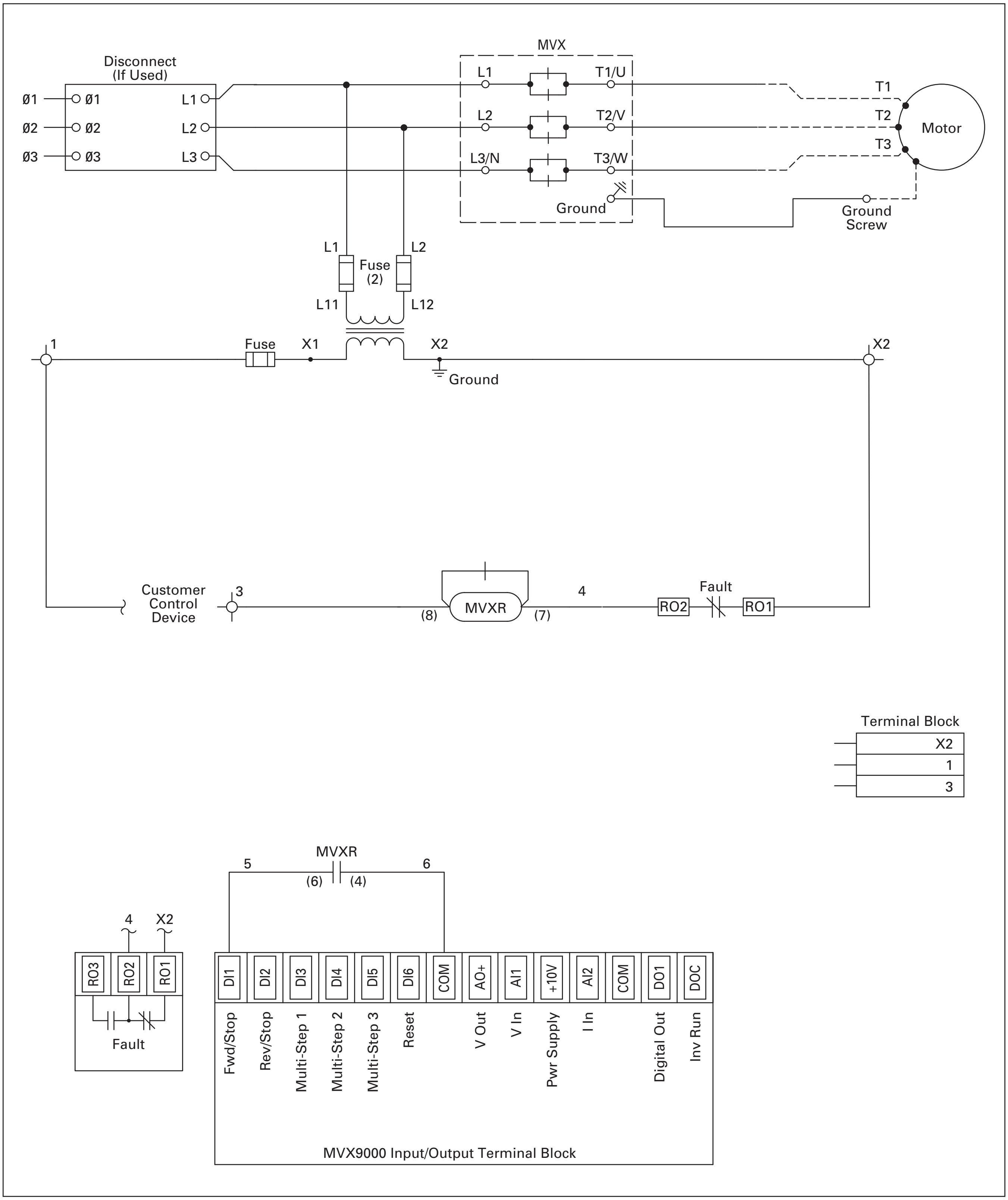


Figure 40-10. MVX9000 Wiring Diagram

Contents



SLX9000 Open Drive

Product Description

Cutler-Hammer® SLX9000 Series Adjustable Frequency Drives from Eaton's electrical business are the next generation of drives specifically engineered for today's commercial and industrial applications. The power unit makes use of the most sophisticated semiconductor technology and a highly modular construction that can be flexibly adapted to the customer's needs.

The input and output configuration (I/O) is designed with modularity in mind. The I/O is compromised of option cards, each with its own input and output configuration.

The control module is designed to accept a total of two of these cards. The cards contain not only normal analog and digital inputs but also fieldbus cards.

These drives continue the tradition of robust performance, and raise the bar on features and functionality, ensuring the best solution at the right price.

The 9000X Family of Drives includes HVX9000, SVX9000, SLX9000 and SPX9000. 9000X Series drive ratings are rated for either high overload (I_H) or low overload (I_L). I_L indicates 110% overload capacity for 1 minute out of 10 minutes. I_H indicates 150% overload capacity for 1 minute out of 10 minutes.

Features

- Robust design — proven 500,000 hours MTBF
- Integrated 3% line reactors standard
- EMI/RFI Filters H standard
- Simplified operating menu allows for typical programming changes, while programming mode provides control of everything
- Keypad — LCD operation from keypad
- Standard NEMA Type 12 keypad on all drives
- The SLX9000 can be flexibly adapted to a variety of needs using our pre-installed "All-In-One Application" programs
- Additional I/O and communication cards provide plug and play functionality
- I/O connections with simple quick connection terminals
- The SLX9000 accommodates the standard I/O and an integrated RS-485 (Modbus) connection. There is room for two option cards with more I/O or other functionality
- UL Listed
- Hand-Held Auxiliary 24V Power Supply allows programming/monitoring of control module without applying full power to the drive
- Control logic can be powered from an external auxiliary control panel, internal drive functions and fieldbus if necessary
- Brake Chopper standard
- NEMA Type 1 and NEMA Type 12 enclosures available

Technical Data and Specifications

Table 40-34. SLX9000 Specifications

Description	Specification
Input Ratings	
Input Voltage (V_{in})	+10% / -15%
Input Frequency (f_{in})	50/60 Hz (variation up to 45 – 66 Hz)
Connection to Power	Once per minute or less (typical operation)
High Withstand Rating	100 kAIC
Output Ratings	
Output Voltage	0 to V_{in}
Continuous Output Current	I_H rated 100% at 122°F (50°C) I_L rated 100% at 104°F (40°C)
Overload Current (I_H/I_L)	150% I_H, 110% I_L for 1 min.
Output Frequency	0 to 320 Hz
Frequency Resolution	.01 Hz
Initial Output Current (I_H)	250% for 2 seconds
Control Characteristics	
Control Method	Frequency Control (V/f) Open Loop: Sensorless Vector Control
Switching Frequency	Adjustable with Parameter 2.6.9 1 to 16 kHz; default 10 kHz
Frequency Reference	Analog Input: Resolution .1% (10-bit), accuracy ± 1% V/Hz Panel Reference: Resolution .01 Hz
Field Weakening Point	30 to 320 Hz
Acceleration Time	0 to 3000 sec.
Deceleration Time	0 to 3000 sec.
Braking Torque	DC brake: 30% x T_n (without brake option)
Ambient Conditions	
Ambient Operating Temperature	14°F (-10°C), no frost to 122°F (+50°C) I_H 14°F (-10°C), no frost to 104°F (+40°C) I_L
Storage Temperature	-40°F (-40°C) to 158°F (70°C)
Relative Humidity	0 to 95% RH, noncondensing, non-corrosive, no dripping water
Air Quality	Chemical vapors: IEC 721-3-3, unit in operation, class 3C2; Mechanical particles: IEC 721-3-3, unit in operation, class 3S2
Altitude	100% load capacity (no derating) up to 3280 ft. (1000m); 1% derating for each 328 ft. (100m) above 3280 ft. (1000m); max. 9842 ft. (3000m)
Vibration	EN 50178, EN 60068-2-6; 5 to 50 Hz, Displacement amplitude 1 mm (peak) at 3 to 15.8 Hz, Max. acceleration amplitude 1G at 15.8 to 150 Hz
Shock	EN 50178, EN 60068-2-27 UPS Drop test (for applicable UPS weights) Storage and shipping: max. 15G, 11 ms (in package)
Enclosure Class	NEMA 1/IP21 or NEMA 12/IP54
Standards	
Product	IEC 61800-2
Safety	UL 508C
EMC (at default settings)	Immunity: Fulfills all EMC immunity requirements; Emissions: EN 61800-3, LEVEL H
Control Connections	
Analog Input Voltage	0 to 10V, R = 200 kΩ (-10 to 10V joystick control) Resolution .1%; accuracy ±1%
Analog Input Current	0(4) to 20 mA; R_i - 250Ω differential
Digital Inputs	Positive or negative logic; 18 to 30V DC
Auxiliary Voltage	+24V ±15%, max. 250 mA
Output Reference Voltage	+10V +3%, max. load 10 mA
Analog Output	0(4) to 20 mA; R_L max. 500Ω; Resolution 10 bit; Accuracy ±2%
Relay Outputs	1 programmable Form C relay output Switching capacity: 24V DC / 8A, 250V AC / 8A, 125V DC / 0.4A
Protections	
Overcurrent Protection	Trip limit 4.0 x I_H instantaneously
Overvoltage Protection	Yes
Undervoltage Protection	Yes
Earth Fault Protection	In case of earth fault in motor or motor cable, only the frequency converter is protected
Input Phase Supervision	Trips if any of the input phases are missing
Motor Phase Supervision	Trips if any of the output phases are missing
Overtemperature Protection	Yes
Motor Overload Protection	Yes
Motor Stall Protection	Yes
Motor Underload Protection	Yes
Short Circuit Protection	Yes (+24V and +10V Reference Voltages)

Table 40-35. Standard I/O Specifications

Description	Specification
3– Digital Input Programmable	24V: "0" ≤ 10V, "1" ≥ 18V,R_i > 5 kΩ
2 – Analog Input Configurable w/Jumpers	Voltage: 0 – ±10V, R_i > 200 kΩ Current: 0 (4) – 20 mA, R_i = 250 kΩ
1 – Digital Output Programmable	Form C Relays 250V AC 2 Amp or 30V DC2 Amp resistive, 8 Amp switching
1 – Analog Output Programmable Configurable w/Jumper	0 – 20 mA, R_L < 500 ohms, resolution 10 Bits/0.1%
1 – RS-485 Serial	RS-485 Modbus Communication

Catalog Number Selection

Table 40-36. SLX9000 Adjustable Frequency Drive Catalog Numbering System

S L X 0 1 0 A 1 – 4 A 1 B 0 _ _ _ _ _ _

Product Family
SLX = Open Drives

Horsepower Rating	
001 = 1 hp	**007** = 7-1/2 hp
F15 = 1-1/2 hp	**010** = 10 hp
002 = 2 hp	**015** = 15 hp
003 = 3 hp	**020** = 20 hp
005 = 5 hp	**025** = 25 hp
006 = 6 hp	**030** = 30 hp

AFD Software Series
A = Standard Software

Enclosure	
1 = NEMA Type 1	**2** = NEMA Type 12

Voltage Rating
4 = 480 (380 – 500) V

Keypad
A = Alphanumeric

Input Options
1 = 3-phase, EMC H

Brake Chopper Options ①
B = Internal Brake Chopper Circuit

Board Modifications
0 = No Standard Boards
2 = Conformal (Varnished) Coating ②

Options
Options appear in alphabetical order.
Extended I/O Card Options
AA = 3 DI, 1 RO (NO/NC), 1 DO
AI = 3 DI, 1 RO (NO), 1 TI
B2 = 1 RO (NC/NO), 1 RO (NO), 1 Therm
B4 = 1 AI (mA isolated), 2 AO (mA isolated), 1 ext +24V DC/EXT + 24V DC
B5 = 3 RO (NO)
Communication Cards
CA = Johnson Controls N2
CI = Modbus TCP
CJ = BACnet
C2 = Modbus
C3 = Profibus DP
C4 = LonWorks
C5 = Profibus DP (D9 Connector)
C6 = CANopen (Slave)
C7 = DeviceNet

① 480V Drives up to 30 hp (I_H) are only available with Brake Chopper Option **B**.
② Factory promise delivery. Consult Sales Office for availability.

Product Selection

480V SLX9000 Drives

Table 40-37. 380 – 500V, NEMA Type 1 Drive

Frame Size	Delivery Code	hp (I_H)	Current (I_H)	hp (I_L)	Current (I_L)	Catalog Number	Price U.S. $
MF4	W	1	2.2	1-1/2	3.3	**SLX001A1-4A1B0**	
		1-1/2	3.3	2	4.3	**SLXF15A1-4A1B0**	
		2	4.3	3	5.6	**SLX002A1-4A1B0**	
		3	5.6	5	7.6	**SLX003A1-4A1B0**	
		5	7.6	—	9	**SLX005A1-4A1B0**	
		—	9	7-1/2	12	**SLX006A1-4A1B0**	
MF5	W	7-1/2	12	10	16	**SLX007A1-4A1B0**	
		10	16	15	23	**SLX010A1-4A1B0**	
		15	23	20	31	**SLX015A1-4A1B0**	
MF6	W	20	31	25	38	**SLX020A1-4A1B0**	
		25	38	30	46	**SLX025A1-4A1B0**	
		30	46	40	61	**SLX030A1-4A1B0**	

Table 40-38. 380 – 500V, NEMA Type 12 Drive

Frame Size	Delivery Code	hp (I_H)	Current (I_H)	hp (I_L)	Current (I_L)	Catalog Number	Price U.S. $
MF4	F1	1	2.2	1-1/2	3.3	**SLX001A2-4A1B0**	
		1-1/2	3.3	2	4.3	**SLXF15A2-4A1B0**	
		2	4.3	3	5.6	**SLX002A2-4A1B0**	
		3	5.6	5	7.6	**SLX003A2-4A1B0**	
		5	7.6	—	9	**SLX005A2-4A1B0**	
		—	9	7-1/2	12	**SLX006A2-4A1B0**	
MF5	F1	7-1/2	12	10	16	**SLX007A2-4A1B0**	
		10	16	15	23	**SLX010A2-4A1B0**	
		15	23	20	31	**SLX015A2-4A1B0**	
MF6	F1	20	31	25	38	**SLX020A2-4A1B0**	
		25	38	30	46	**SLX025A2-4A1B0**	
		30	46	40	61	**SLX030A2-4A1B0**	

Discount Symbol **SS-2**

SLX9000 Series Option Board Kits

The SLX9000 Series drives can accommodate a wide selection of expander and adapter option boards to customize the drive for your application needs. The drive's control unit is designed to accept a total of two option boards (see **Figure 40-11**).

The SLX9000 Drive accommodates the standard I/O and an integrated RS-485 (Modbus) connector.

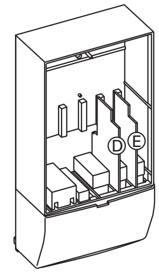


Figure 40-11. SLX9000 Series Option Boards

Table 40-39. Option Board Kits

Option Kit Description ②	Allowed Slot Locations ①	Field Installed		Factory Installed		SLX9000 Programs
		Catalog Number	Price U.S. $	Option Designator	Adder U.S. $	
Extended I/O Card Options						
3 DI, 1 RO (NO/NC), 1 DO	**D**	**OPTAA**		**AA**		X
3 DI, 1 RO (NO), 1 TI	**D**	**OPTAI**		**AI**		X
1 RO (NC/NO), 1 RO (NO), 1 Therm	**D**, E	**OPTB2**		**B2**		X
1 AI (mA isolated), 2 AO (mA isolated), 1 ext +24V DC/EXT +24V DC	**D**, E	**OPTB4**		**B4**		X
3 RO (NO)	**D**, E	**OPTB5**		**B5**		X
Communication Cards						
Johnson Controls N2	D, **E**	**OPTC2**		**CA**		X
Modbus TCP	D, **E**	**OPTCI**		**CI**		X
BACnet	D, **E**	**OPTCJ**		**CJ**		X
Modbus	D, **E**	**OPTC2**	.	**C2**		X
Profibus DP	D, **E**	**OPTC3**		**C3**		X
LonWorks	D, **E**	**OPTC4**		**C4**		X
Profibus DP (D9 Connector)	D, **E**	**OPTC5**		**C5**		X
CanOpen (Slave)	D, **E**	**OPTC6**		**C6**		X
DeviceNet	D, **E**	**OPTC7**		**C7**		X
Keypad						
SLX9000 Series LCD Keypad (Replacement Keypad)		**KEYPAD-LCD**		**—**		X
SLX9000 Series Remote Mount Keypad Unit (Keypad not included, includes 6.5 ft. cable, keypad holder, mounting hardware)		**OPTDRA-02L**		**—**		X

① Option card must be installed in one of the slots listed for that card. Slot indicated in **Bold** is the preferred location.
② AI = Analog Input; AO = Analog Output, DI = Digital Input, DO = Digital Output, RO = Relay Output

Johnson Controls Metasys™ N2 Network Communications

The OPTC2 fieldbus board provides communication between the 9000X Drive and a Johnson Controls Metasys™ N2 network. With this connection, the drive can be controlled, monitored and programmed from the Metasys system. The N2 fieldbus is available as a factory installed option and as a field installable kit.

Modbus/TCP Network Communications

The Modbus/TCP Network Card OPTCI is used for connecting the 9000X Drive to Ethernet networks utilizing Modbus protocol. It includes an RJ-45 pluggable connector. This interface provides a selection of standard and custom register values to communicate drive parameters. The board supports 10 Mbps and 100 Mbps communication speeds. The IP address of the board is configurable over Ethernet using a supplied software tool.

BACnet Network Communications

The BACnet Network Card OPTCJ is used for connecting the 9000X Drive to BACnet networks. It includes a 5.08 mm pluggable connector. Data transfer is Master-Slave/Token Passing (MS/TP) RS-485. This interface uses a collection of 30 Binary Value Objects (BVOs) and 35 Analog Value Objects (AVOs) to communicate drive parameters. The card supports 9.6, 19.2 and 38.4 Kbaud communication speeds and supports network addresses 1 – 127.

Modbus RTU Network Communications

The Modbus Network Card OPTC2 is used for connecting the 9000X Drive as a slave on a Modbus network. The interface is connected by a 9-pin DSUB connector (female) and the baud rate ranges from 300 to 19200 baud. Other communication parameters include an address range from 1 to 247; a parity of None, Odd or Even; and the stop bit is 1.

Profibus Network Communications

The Profibus Network Card OPTC3 is used for connecting the 9000X Drive as a slave on a Profibus-DP network. The interface is connected by a 9-pin DSUB connector (female). The baud rates range from 9.6K baud to 12M baud, and the addresses range from 1 to 127.

Discount Symbol SS-3

LonWorks Network Communications

The LonWorks Network Card OPTC4 is used for connecting the 9000X Drive on a LonWorks network. This interface uses Standard Network Variable Types (SNVT) as data types. The channel connection is achieved using a FTT-10A Free Topology transceiver via a single twisted transfer cable. The communication speed with LonWorks is 78 kBits/s.

CanOpen (Slave) Communications

The CanOpen (Slave) Network Card OPTC6 is used for connecting the 9000X Drive to a host system. According to ISO11898 standard cables to be chosen for CAN bus should have a nominal impedance of 120Ω, and specific line delay of nominal 5 nS/m. 120Ω line termination resistors required for installation.

DeviceNet Network Communications

The DeviceNet Network Card OPTC7 is used for connecting the 9000X Drive on a DeviceNet Network. It includes a 5.08 mm pluggable connector. Transfer method is via CAN using a 2-wire twisted shielded cable with 2-wire bus power cable and drain. The baud rates used for communication include 125K baud, 250K baud and 500K baud.

Options

Control Panel Options

Table 40-40. Control Panel Factory Options

Description	Factory Installed		Field Installed	
			NEMA Type 1	
	Option Code	Adder U.S. $	Catalog Number	Price U.S. $
SLX9000 Series LCD Keypad — This option is standard on all drives and consists of an RS-232 connection, backlit alphanumeric LCD display with nine indicators for the RUN status and two indicators for the control source. The seven pushbuttons on the panel are used for panel programming and monitoring of all SLX9000 parameters. The panel is detachable and isolated from the input line potential.	A		KEYPAD-LCD	
Keypad Remote Mounting Kit — This option is used to remote mount the SLX9000 keypad. Includes 6.5 ft. cable, keypad holder and mounting hardware.	—		OPTDRA-02L	

Table 40-41. Miscellaneous Options

Description	Catalog Number	Price U.S. $
External Dynamic Braking Resistors — Used with the Dynamic Braking Chopper Circuit to absorb motor regenerative energy for stopping the load and to dissipate the energy flowing back into the drive. Resistors are separated into Standard Duty and Heavy-Duty. Standard Duty is defined as 20% duty or less with 100% braking torque, while Heavy-Duty is defined as 50% duty or less with 150% braking torque. *Consult factory.*	①	

① Consult factory.

Brake Chopper Options

The Brake Chopper Circuit option is used for applications that require dynamic braking. Dynamic Braking resistors are not included with drive purchase. Consult the factory for dynamic braking resistors which are supplied separately. Resistors are not UL Listed.

Table 40-42. Conformal (Varnished) Coating Adder — 380 – 500V,
(See Catalog Number Description to order.)

Frame	Delivery Code	Adder U.S. $
MF4	FP	
MF5	FP	
MF6	FP	

Table 40-43. Conformal Coated Board Kits ②

Field Installed		Factory Installed	
Catalog Number	Price U.S. $	Option Designator	Adder U.S. $
OPT_V ④		③	

② See Option Catalog Numbers on **Page 40-31**.
③ Construct Catalog Numbers for factory installed per **Table 40-36** on **Page 40-29**.
④ Replace "__" with the correct Catalog Number from **Page 40-31**. Example: OPT**C2**V.

Discount Symbol **SS-2**

Accessories

NEMA Type 12 Conversion Kit

The NEMA Type 12 kit option is used to convert a NEMA Type 1 to a NEMA Type 12 drive. The NEMA Type 12 Kit consists of a metal drive shroud, fan kit for some frames, adapter plate and plugs.

Table 40-44. NEMA Type 12 Conversion Kit

Frame Size	Delivery Code	Approximate Dimensions in Inches (mm)			Approximate Weight in Lb. (kg)	Catalog Number	Price U.S. $
		Length	Width	Height	Weight		
MF4	W	13 (330)	7 (178)	4 (102)	4 (1.8)	**OPTN12FR4**	
MF5	W	16 (406)	8 (203)	7 (178)	5 (2.3)	**OPTN12FR5**	
MF6	W	21 (533)	10 (254)	5 (127)	7 (3.2)	**OPTN12FR6**	

Flange Kits

Flange Kit Type 12

The flange kit is utilized when the power section is mounted through the back panel of an enclosure. Includes flange mount brackets and NEMA Type 12 fan components. Metal shroud not included.

Table 40-45. Flange Kit Type 12 — MF4 – MF6 ①

Frame Size	Delivery Code	Catalog Number	Price U.S. $
MF4	W	**OPTTHRFR4**	
MF5	W	**OPTTHRFR5**	
MF6	W	**OPTTHRFR6**	

① For installation of an SLX9000 NEMA Type 1 drive into a NEMA Type 12 oversized enclosure.

Flange Kit Type 1

Flange kits for NEMA 1 enclosure drive rating are determined by rating of drive.

Table 40-46. Flange Kit Type 1 — MF4 – MF6 ②

Frame Size	Delivery Code	Catalog Number	Price U.S. $
MF4	FP	**OPTTHR4**	
MF5	FP	**OPTTHR5**	
MF6	FP	**OPTTHR6**	

② For installation of an SLX9000 NEMA Type 1 drive into a NEMA Type 1 oversized enclosure.

Flange Kit Type 12

Flange kits for NEMA 12 enclosure drive rating are determined by rating of drive.

Table 40-47. Flange Kit Type 12 — MF4 – MF6 ③

Frame Size	Delivery Code	Catalog Number	Price U.S. $
MF4	FP	**OPTTHR4**	
MF5	FP	**OPTTHR5**	
MF6	FP	**OPTTHR6**	

③ For installation of an SLX9000 NEMA Type 12 drive into a NEMA Type 12 oversized enclosure.

Discount Symbol **SS-2**

Dimensions

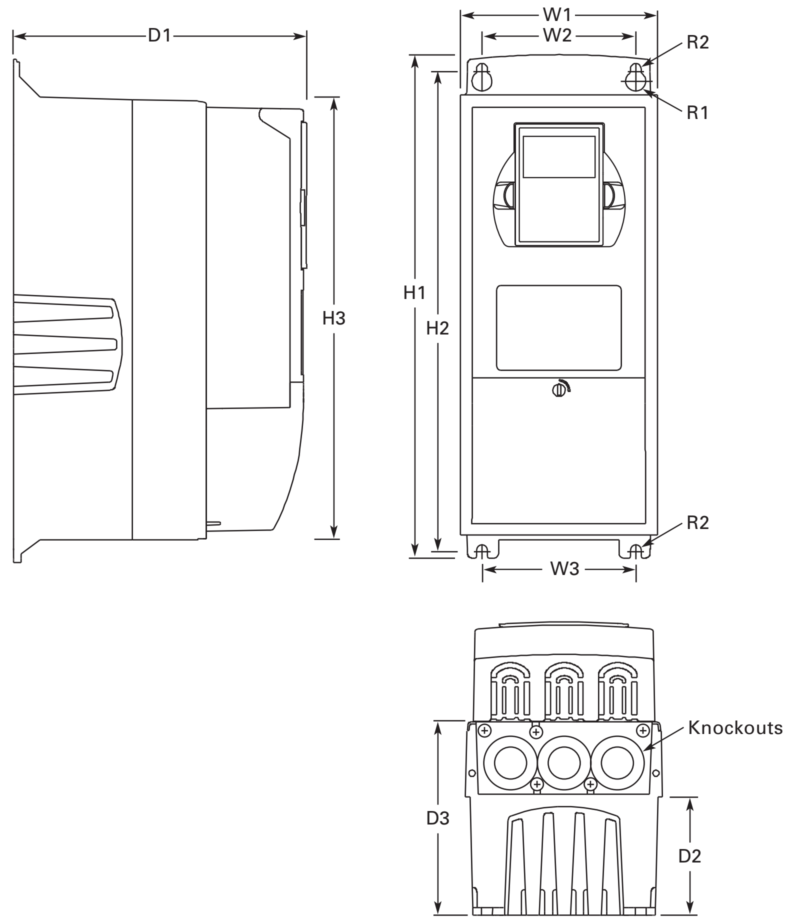


Figure 40-12. NEMA Type 1 and NEMA Type 12 SLX9000 Drive Dimensions, MF4 – MF6

Table 40-48. SLX9000 Drive Dimensions

Frame Size	Voltage	hp (I_H)	Approximate Dimensions in Inches (mm)											Weight Lbs. (kg)	Knockouts @ Inches (mm)
			H1	H2	H3	D1	D2	D3	W1	W2	W3	R1 dia.	R2 dia.		N1 (O.D.)
MF4	480V	1 – 5	12.9 (327)	12.3 (313)	11.5 (292)	7.5 (190)	3.0 (77)	5.0 (126)	5.0 (128)	3.9 (100)	—	.5 (13)	.3 (7)	11.0 (5)	3 @ 1.1 (28)
MF5	480V	7-1/2 – 15	16.5 (419)	16.0 (406)	15.3 (389)	8.4 (214)	3.9 (100)	5.8 (148)	5.6 (143)	3.9 (100)	—	.5 (13)	.3 (7)	17.9 (8)	2 @ 1.5 (37) 1 @ 1.1 (28)
MF6	480V	20 – 30	22.0 (558)	21.3 (541)	20.4 (519)	9.3 (237)	4.2 (105)	6.5 (165)	7.6 (195)	5.8 (148)	—	.6 (15.5)	.4 (9)	40.8 (19)	3 @ 1.5 (37)

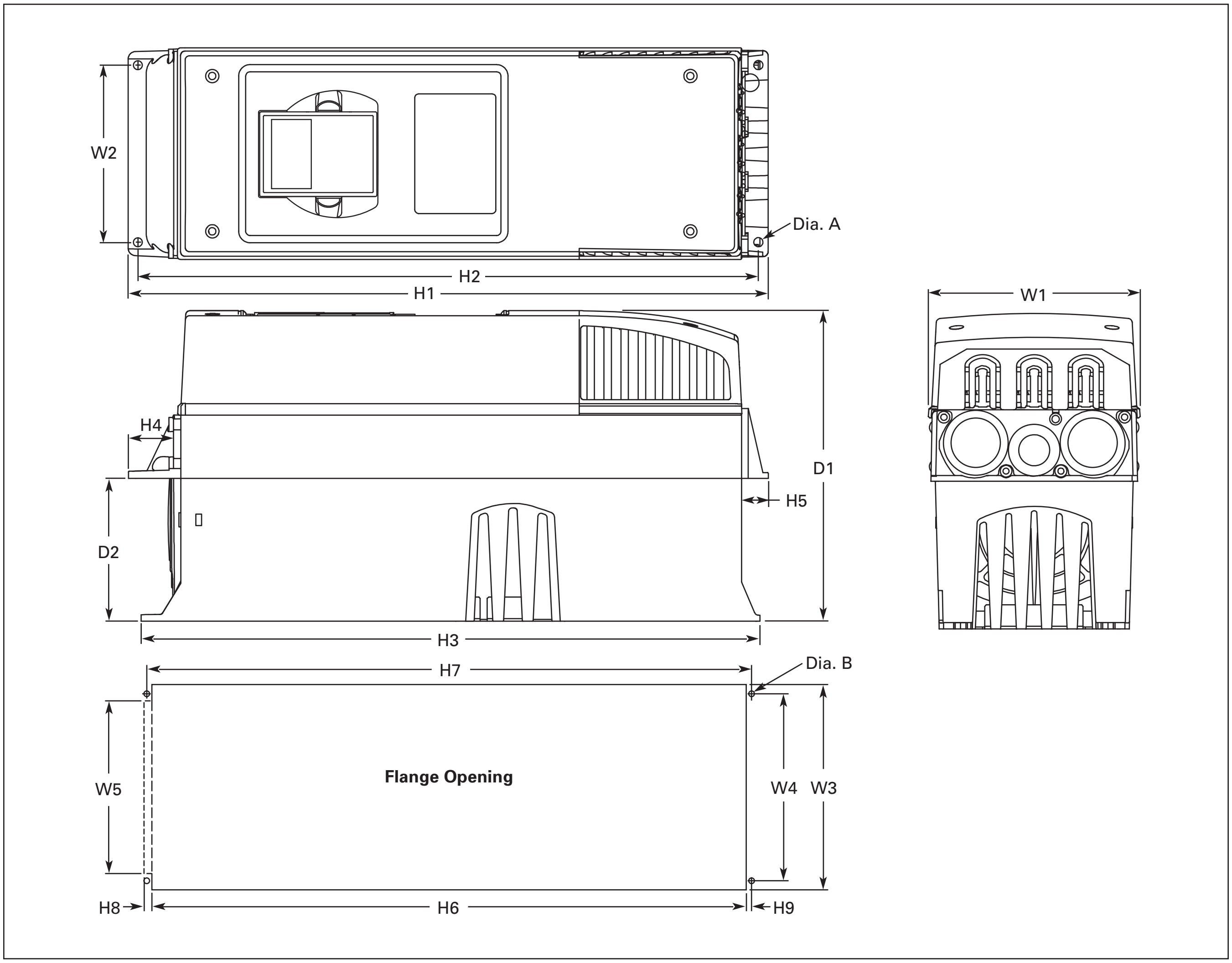


Figure 40-13. SLX9000 Dimensions, NEMA Type 1 and NEMA Type 12 with Flange Kit, MF4 – MF6

Table 40-49. Dimensions for SLX9000, MF4 – MF6 with Flange Kit

Frame Size	Approximate Dimensions in Inches (mm)									
	W1	W2	H1	H2	H3	H4	H5	D1	D2	Dia. A
MF4	5.0 (128)	4.5 (113)	13.3 (337)	12.8 (325)	12.9 (327)	1.2 (30)	.9 (22)	7.5 (190)	3.0 (77)	.3 (7)
MF5	5.6 (143)	4.7 (120)	17.0 (434)	16.5 (420)	16.5 (419)	1.4 (36)	.7 (18)	8.4 (214)	3.9 (100)	.3 (7)
MF6	7.7 (195)	6.7 (170)	22.0 (560)	21.6 (549)	22.0 (558)	1.2 (30)	.8 (20)	9.3 (237)	4.2 (106)	.3 (7)

Table 40-50. Dimensions for the Flange Opening, MF4 – MF6

Frame Size	Approximate Dimensions in Inches (mm)							
	W3	W4	W5	H6	H7	H8	H9	Dia. B
MF4	4.8 (123)	4.5 (113)	—	12.4 (315)	12.8 (325)	—	.2 (5)	.3 (7)
MF5	5.3 (135)	4.7 (120)	—	16.2 (410)	16.5 (420)	—	.2 (5)	.3 (7)
MF6	7.3 (185)	6.7 (170)	6.2 (157)	21.2 (539)	21.6 (549)	.3 (7)	.2 (5)	.3 (7

Spare Units & Replacement Parts

Table 40-51. SLX9000 Spare Units & Replacement Parts

Frame	MF4						MF5			MF6			Delivery Code	Catalog Number	Price U.S. $
hp (I_H)	1	1-1/2	2	3	5	7-1/2 ①	7-1/2	10	15	20	25	30			
Control Board															
	1	1	1	1	1	1	1	1	1	1	1	1	W	**VB00351**	
Power Boards															
	1												FB	**VB00350-0003-5**	
		1											FB	**VB00350-0004-5**	
			1										FB	**VB00350-0005-5**	
				1									FB	**VB00350-0007-5**	
					1								FB	**VB00350-0009-5**	
						1							FB	**VB00350-0012-5**	
							1						FB	**VB00357-0016-5**	
								1					FB	**VB00357-0023-5**	
									1				FB	**VB00357-0031-5**	
										1			FB	**VB00358-0038-5**	
											1		FB	**VB00358-0046-5**	
												1	FB	**VB00358-0061-5**	
Electrolytic Capacitors															
	2	2	2	2									W	**PP01000**	
					2	2							W	**PP01001**	
							2	2					W	**PP01002**	
									2				W	**PP01003**	
										2	2	2	W	**PP01004**	
Cooling Fans															
	1	1	1	1	1	1							W	**PP01060**	
							1	1	1				W	**PP01061**	
										1	1	1	W	**PP01062**	
	1	1	1	1	1	1							W	**PP01086**	
							1	1	1				W	**PP01088**	
										1	1	1	W	**PP01049**	
IGBT Modules															
							1						W	**CP01306**	
								1					W	**CP01307**	
									1				W	**CP01308**	
										1	1		W	**CP01367**	
												1	W	**CP01368**	
										1	1		W	**PP01022**	
												1	W	**PP01023**	
	1	1	1										FP	**PP01032**	
				1	1	1							FP	**PP01033**	
Capacitors															
	1	1	1	1	1	1							FP	**PP04051**	
	1	1	1	1	1	1							FP	**PP04052**	
							1	1	1				FP	**PP05051**	
							2	2	2				FP	**PP00035**	
										1	1	1	FP	**PP06051**	
										1	1	1	FP	**PP06052**	

① I_L only; has no corresponding I_H rated hp rating.

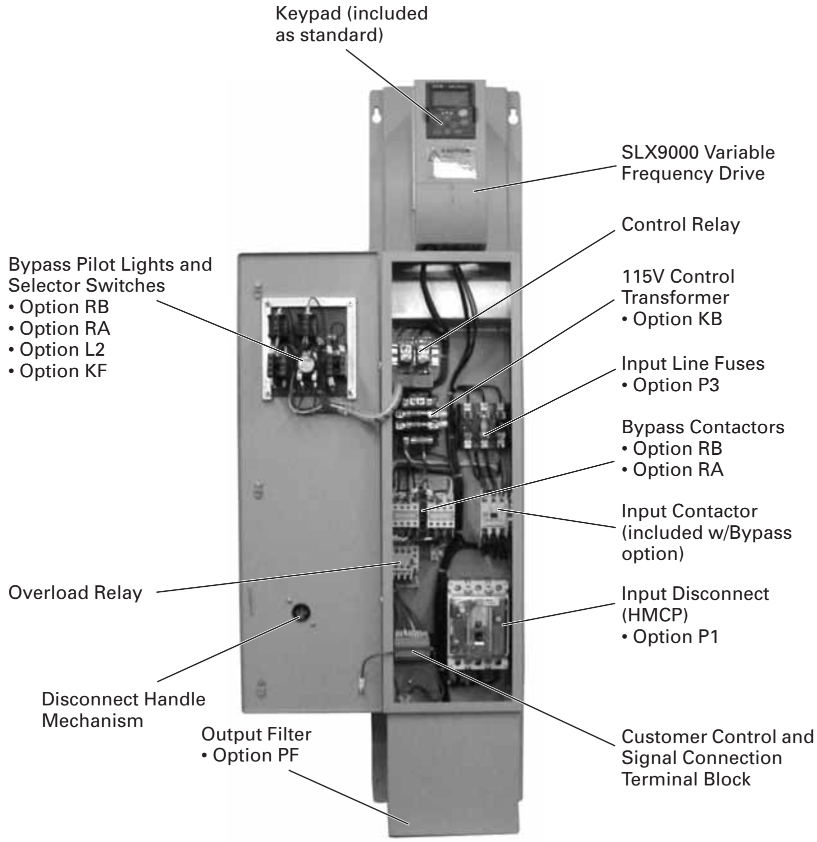
Discount Symbol **SS-2**

Contents

Product Description

- **Standard Enclosed** — covers a wide range of the most commonly ordered options. Pre-engineering eliminates the lead time normally associated with customer specific options.
- **Modified Standard Enclosed** — applies to specific customer requirements that vary from the Standard Enclosed offering, such as the need for an additional indicating light or minor modifications to drawings. *Consult your Eaton representative for assistance in pricing and lead time.*
- **Custom Engineered** — for those applications with more unique or complex requirements, these are individually engineered to the customer's needs. *Consult your Eaton representative for assistance in pricing and lead time.*

SLX9000 Enclosed Drives



Enclosed 9000X Series Drive

Features

- NEMA Type 1, Type 12 or Type 3R enclosures
- Input Voltage: 480V
- Complete range of control, network and power options
- Horsepower range:
  - ❑ 480V — 1 to 30 hp I_H; 1-1/2 to 40 hp I_L
- HMCP padlockable

Standards and Certifications

- UL Listed
- cUL Listed

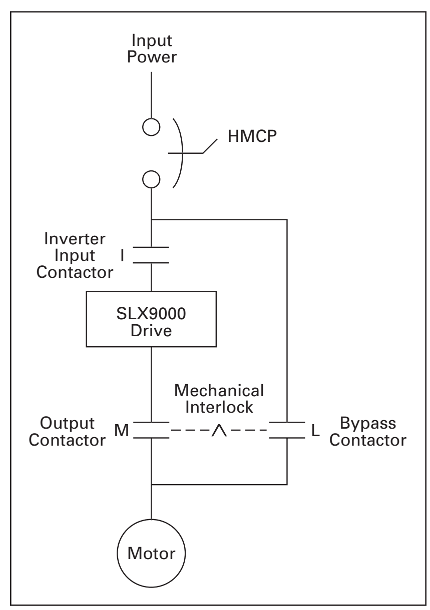


Figure 40-14. Power Diagram for Bypass Options RB and RA

Technical Data and Specifications

Table 40-52. Specifications

Feature Description	SLX9000 Enclosed Products — NEMA Type 1, NEMA Type 12 or NEMA Type 3R
Primary Design Features	
45 – 66 Hz Input Frequency	Standard
Output: AC Volts Maximum	Input Voltage Base
Output Frequency Range: Hz	0 – 320
Initial Output Current (I_H)	250% for 2 seconds
Overload: 1 Minute (I_H/I_L)	150%/110%
Enclosure Space Heater	Optional
Oversize Enclosure	Standard
Output Contactor	Optional
Bypass Motor Starter	Optional
Listings	UL, cUL
Protection Features	
Incoming Line Fuses	Optional
AC Input Circuit Disconnect	Optional
Line Reactors	Standard
Phase Rotation Insensitive	Standard
EMI Filter	Standard
Input Phase Loss Protection	Standard
Input Overvoltage Protection	Standard
Line Surge Protection	Standard
Output Short Circuit Protection	Standard
Output Ground Fault Protection	Standard
Output Phase Protection	Standard
Overtemperature Protection	Standard
DC Overvoltage Protection	Standard
Drive Overload Protection	Standard
Motor Overload Protection	Standard
Programmer Software	Optional
Local/Remote Keypad	Standard
Keypad Lockout	Standard
Fault Alarm Output	Standard
Built-In Diagnostics	Standard
Input/Output Interface Features	
Setup Adjustment Provisions:	
Remote Keypad/Display	Standard
Personal Computer	Standard
Operator Control Provisions:	
Drive Mounted Keypad/Display	Standard
Remote Keypad/Display	Standard
Conventional Control Elements	Standard
Serial Communications	Optional
115V AC Control Circuit	Optional
Speed Setting Inputs:	
Keypad	Standard
0 – 10V DC Potentiometer/Voltage Signal	Standard
4 – 20 mA Isolated	Configurable
4 – 20 mA Differential	Configurable
3 – 15 psig	Optional
Analog Outputs:	
Speed/Frequency	Standard
Torque/Load/Current	Programmable
Motor Voltage	Programmable
Kilowatts	Programmable
0 – 10V DC Signals	Configurable w/Jumpers
4 – 20 mA DC Signals	Standard
Isolated Signals	Optional
Input/Output Interface Features (Continued)	
Discrete Outputs:	
Fault Alarm	Standard
Drive Running	Standard
Drive at Set Speed	Programmable
Optional Parameters	14
Dry Contacts	1 (Relay Form C)
Additional Discrete Outputs	Optional
Communications:	
RS-232	Standard
RS-422/485	Optional
DeviceNet™	Optional
Modbus RTU	Optional
CanOpen (Slave)	Optional
Profibus-DP	Optional
Lonworks®	Optional
Johnson Controls Metasys™ N2	Optional
Performance Features	
Sensorless Vector Control	Standard
Volts/Hertz Control	Standard
IR and Slip Compensation	Standard
Electronic Reversing	Standard
Dynamic Braking	Standard
DC Braking	Standard
PID Setpoint Controller	Programmable
Critical Speed Lockout	Standard
Current (Torque) Limit	Standard
Adjustable Acceleration/Deceleration	Standard
Linear or S Curve Accel/Decel	Standard
Jog at Preset Speed	Standard
Thread/Preset Speeds	7
Automatic Restart	Selectable
Coasting Motor Start	Standard
Coast or Ramp Stop Selection	Standard
Elapsed Time Meter	Optional
Carrier Frequency Adjustment	1 – 16 kHz
Standard Conditions for Application and Service	
Operating Ambient Temperature	0 – 40°C
Storage Temperature	-40 – 60°C
Humidity (Maximum), Non-condensing	95%
Altitude (Maximum without Derate)	3300 ft. (1000m)
Line Voltage Variation	+10/-15%
Line Frequency Variation	45 – 66 Hz
Efficiency	>96%
Power Factor (Displacement)	>96

Table 40-53. Standard I/O Specifications

Description	Specification
3– Digital Input Programmable	24V: "0" ≤ 10V, "1" ≥ 18V,R_i > 5 kΩ
2 – Analog Input Configurable w/Jumpers	Voltage: 0 – ±10V, R_i > 200 kΩ Current: 0 (4) – 20 mA, R_i = 250 kΩ
1 – Digital Output Programmable	Form C Relays 250V AC 2 Amp or 30V DC2 Amp resistive, 8 Amp switching
1 – Analog Output Programmable Configurable w/Jumper	0 – 20 mA, R_L < 500 ohms, resolution 10 Bits/0.1%
1 – RS-485 Serial	RS-485 Modbus Communication

Catalog Number Selection

Table 40-54. SLX9000 Enclosed NEMA Type 1/12/3R Drive Catalog Numbering System

SLX 010 1 4 B A _ _ _ _ _ _ _ _ _ _ _ (Build Alphabetically and Numerically)

Product Family
SLX = Enclosed Drives

Horsepower Rating	
F07 = 3/4 hp	**010** = 10 hp
001 = 1 hp	**015** = 15 hp
F15 = 1-1/2 hp	**020** = 20 hp
002 = 2 hp	**025** = 25 hp
003 = 3 hp	**030** = 30 hp
005 = 5 hp	**040** = 40 hp
007 = 7-1/2 hp	

Enclosure Rating
1 = NEMA Type 1
2 = NEMA Type 12
3 = NEMA Type 3R

Voltage Rating
4 = 480V

Application — Torque/Braking ①
B = I_L/Internal Brake Chopper
E = I_H/Internal Brake Chopper

Enclosed Style
A = Enclosed Drive

Enclosed Options ③		Type
K1	Door-Mounted Speed Potentiometer ②	Control
K2	Door-Mounted Speed Potentiometer with HOA Selector Switch ②	Control
K3	3 – 15 psig Follower	Control
K4	HAND/OFF/AUTO Switch (22 mm)	Control
K5	MANUAL/AUTO Ref Switch (22 mm)	Control
K6	START/STOP Pushbuttons (22 mm)	Control
KB	115V Control Transformer – 150 VA	Control
KF	Bypass Test Switch for RA and RB	Addl. Bypass
KO	Standard Elapsed Time Meter	Control
L1	Power On and Fault Pilot Lights (22 mm)	Light
L2	Bypass Pilot Lights for RA, RB Bypass Options	Addl. Bypass
LA	Green RUN Light (22 mm)	Light
LD	Green STOP Light (22 mm)	Light
LE	Red RUN Light (22 mm)	Light
LF	Red STOP Light (22 mm)	Light
LJ	Power On Light (22 mm)	Light
LU	Misc. Light (22 mm)	Light
P1	Input Disconnect (HMCP) 100 kAIC	Input
P3	Input Line Fuses (200 kAIC)	Input
P7	Input Power Surge Protection	Input
PE	Output Contactor	Output
PF	Output Filter	Output
PH	Single Overload Relay	Output
PI	Dual Overload Relays	Output
PN	Dual Overloads for Bypass	Addl. Bypass
RA	Manual HOA Bypass Controller	Bypass
RB	Manual IOB Bypass Controller	Bypass
S9	Space Heater	Enclosure

Communication Options ④
C2 = Modbus
C3 = Profibus DP
C4 = LonWorks
C5 = Profibus DP (D9 Connector)
C6 = CanOpen (Slave)
C7 = DeviceNet
CA = Johnson Controls N2
CI = Modbus TCP
CJ = BACnet

Control Options
AA = 3 DI, 1 RO (NO/NC), 1 DO
AI = 3 DI, 1 RO (NO), 1 TI
B2 = 1 RO (NC/NO), 1 RO (NO), 1 Therm
B4 = 1 AI (mA isolated), 2 AO (mA isolated), 1 ext +24V DC/EXT +24V DC
B5 = 3 RO (NO)

① Brake Chopper is factory installed standard. **Note:** External dynamic braking resistors not included. Consult factory.
② Includes local/remote speed reference switch.
③ See **Pages 40-40** and **40-41** for descriptions.
④ See **Pages 40-41** and **40-42** for complete descriptions.

Control/Communication Option Descriptions

Table 40-55. Available Control/Communications Options

Option	Description	Option Type
K1	**Door-Mounted Speed Potentiometer** — Provides the SLX9000 with the ability to adjust the frequency reference using a door-mounted potentiometer. This option uses the 10V DC reference to generate a 0 – 10V signal at the analog voltage input signal terminal. When the HOA bypass option is added, the speed is controlled when the HOA switch is in the hand position. Without the HOA bypass option, a 2-position switch (labeled local/remote) is provided on the keypad to select speed reference from the Speed Potentiometer or a remote speed signal.	Control
K2	**Door-Mounted Speed Potentiometer with HOA Selector Switch** — Provides the SLX9000 with the ability to start/stop and adjust the speed reference from door-mounted control devices or remotely from customer supplied inputs. In HAND position, the drive will start and the speed is controlled by the door-mounted speed potentiometer. The drive will be disabled in the OFF position. When AUTO is selected, the drive run and speed control commands are via user-supplied dry contact and 4 – 20 mA signal.	Control
K3	**3 – 15 psig Follower** — Provides a pneumatic transducer which converts a 3 – 15 psig pneumatic signal to either 0 – 8V DC or a 1 – 9V DC signal interface with the SLX9000.	Control
K4	**HAND/OFF/AUTO Switch for Non-bypass Configurations** — Provides a three-position selector switch that allows the user to select either a Hand or Auto mode of operation. Hand mode is defaulted to keypad operation, and Auto mode is defaulted to control from an external terminal source. These modes of operation can be configured via programming to allow for alternate combinations of start and speed sources. Start and speed sources include Keypad, I/O and FieldBus.	Control
K5	**MANUAL/AUTO Speed Reference Switch** — Provides a door-mounted selector switch for Manual/Auto speed reference.	Control
K6	**START/STOP Pushbuttons** — Provides door-mounted START and STOP pushbuttons for either bypass or non-bypass configurations.	Control
KB	**115V Control Transformer – 150 VA** — Provides a fused control power transformer with 115V for customer use.	Control
KF	**Bypass Test Switch for RB and RA** — Allows the user to energize the AF drive for testing while operating the motor on the bypass controller. The Test Switch is mounted on the inside of the enclosure door.	Addl. Bypass
KO	**Standard Elapsed Time Meter** — Provides a door-mounted elapsed run time meter.	Control
L1	**Power On and Fault Pilot Lights (22 mm)** — Provides a white power on light that indicates power to the enclosed cabinet and a red fault light indicates a drive fault has occurred.	Light
L2	**Bypass Pilot Lights for RB, RA Bypass Options** — A green light indicates when the motor is running in inverter mode and an amber light indicates when the motor is running in bypass mode. The lights are mounted on the enclosure door, above the switches.	Addl. Bypass
LA	**Green RUN Light (22 mm)** — Provides a green run light that indicates the drive is running.	Light
LD	**Green STOP Light (22 mm)** — Provides a green stop light that indicates the drive is stopped.	Light
LE	**Red Run Pilot Light (22 mm)** — Provides a red run pilot light that indicates the drive is running.	Light
LF	**Red STOP Light (22 mm)** — Provides a red stop light that indicates the drive is stopped.	Light
LJ	**Power On Light (22 mm)** — Provides a white power on light that indicates the drive enclosure power is on.	Light
LU	**Misc. Light (22 mm)** — Provides a misc. "user defined" pilot light. User to define light function and color.	Light
P1	**Input Disconnect Assembly Rated to 100 kAIC** — High Interruption Circuit Breaker that provides a means of short circuit protection for the power cables between it and the SLX9000, and protection from high-level ground faults on the power cable. Allows a convenient means of disconnecting the SLX9000 from the line and the operating mechanism can be padlocked in the OFF position. This is factory mounted in the enclosure.	Input
P3	**Input Line Fuses Rated to 200 kAIC** — Provides high-level fault protection of the SLX9000 input power circuit from the load side of the fuses to the input side of the power transistors. This option consists of three 200 kA fuses, which are factory mounted in the enclosure.	Input
P5	**5% Input Reactance**— Add additional input reactance to increase total from 3% standard to optional 5%.	Input
P7	**MOV Surge Suppressor** — Provides a Metal Oxide Varistor (MOV) connected to the line side terminals and is designed to clip line side transients.	Input
PE	**Output Contactor** — Provides a means for positive disconnection of the drive output from the motor terminals. The contactor coil is controlled by the drive's run or permissive logic. NC and NO auxiliary contacts rated at 10A, 600V AC are provided for customer use. Bypass Options **RB** and **RA** include an Output Contactor as standard. This option includes a low VA 115V AC fused Control Power Transformer and is factory mounted in the enclosure.	Output
PF	**Output Filter** — Used to reduce the transient voltage (DV/DT) at the motor terminals. The Output Filter is recommended for cable lengths exceeding 100 ft. (30m) with a drive of 3 hp and above, for cable lengths of 33 ft. (10m) with a drive of 2 hp and below, or for a drive rated at 525 – 690V. This option is mounted in the enclosure, and may be used in conjunction with a Brake Chopper Circuit.	Output
PH	**Single Overload Relay** — Uses a bimetallic overload relay to provide additional overload current protection to the motor on configurations without bypass options. It is included with the Bypass Configurations for overload current protection in the bypass mode. The Overload Relay is mounted within the enclosure, and is manually resettable. Heater pack included.	Output
PI	**Dual Overload Relays** — This option is recommended when a single drive is operating 2 motors and overload current protection is needed for each of the motors. The standard configuration includes two bimetallic overload relays, each sized to protect a motor with 50% of the drive hp rating. For example, a 100 hp drive would include two overload relays sized to protect two 50 hp motors. The relays are mounted within the enclosure, and are manually resettable. Heater packs not included.	Output
PN	**Dual Overloads for Bypass** — This option is recommended when a single drive is operating 2 motors in the bypass mode and overload current protection is needed for each of the motors. The standard configuration includes two bimetallic overload relays, each sized to protect a motor with 50% of the drive hp rating. For example, a 100 hp drive would include two overload relays sized to protect two 50 hp motors. The relays are mounted within the enclosure, and are manually resettable.	Addl. Bypass

Table 40-55. Available Control/Communications Options (Continued)

Option	Description	Option Type
RA	**Manual HOA Bypass Controller** — The Manual HAND/OFF/AUTO (HOA) — 3-contactor — bypass option provides a means of bypassing the SLX9000, allowing the AC motor to be operated at full speed directly from the AC supply line. This option consists of an input disconnect, a fused control power transformer, and a full voltage bypass starter with a door mounted HOA selector switch and an INVERTER/BYPASS switch. The HOA switch provides the ability to start and stop the drive in the inverter mode. A Freedom Series IEC input contactor, a Freedom Series IEC output contactor, and a Freedom Series IEC starter with a bimetallic overload relay is included. The contactors are mechanically and electrically interlocked (see power diagram on **Page 40-37**).	Bypass
RB	**Manual IOB Bypass Controller** — The Manual INVERTER/OFF/BYPASS (IOB) — 3-contactor — bypass option provides a means of bypassing the SLX9000, allowing the AC motor to be operated at full speed directly from the AC supply line. This option consists of an input disconnect, a fused control power transformer, and a full voltage bypass starter with a door mounted IOB selector switch. A Freedom Series IEC input contactor, a Freedom Series IEC output contactor, and a Freedom Series IEC starter with a bimetallic overload relay is included. The contactors are mechanically and electrically interlocked (see power diagram on **Page 40-37**).	Bypass
S9	**Space Heater** — Prevents condensation from forming in the enclosure when the drive is inactive or in storage. Includes a thermostat for variable temperature control. Requires a customer supplied 115V remote supply source.	Enclosure

Note: For availability, see Product Selection for base drive voltage required.

SLX9000 Series Option Board Kits

The SLX9000 Series drives can accommodate a wide selection of expander and adapter option boards to customize the drive for your application needs. The drive's control unit is designed to accept a total of two option boards (see **Figure 40-15**).

The SLX9000 Drive accommodates the standard I/O and an integrated RS-485 (Modbus) connector.

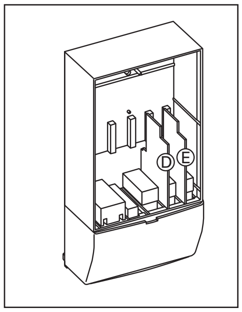


Figure 40-15. 9000X Series Option Boards

Table 40-56. I/O Specifications for the Control/Communication Options

Description	Specifications
Analog voltage, input	0 – ±10V, $R_i \geq 200$ kΩ
Analog current, input	0 (4) – 20 mA, $R_i = 250$ Ω
Digital Input	24V: "0" ≤ 10V, "1" ≥ 18V, $R_i > 5$ kΩ
Aux. voltage	24V (±20%), max. 50 mA
Reference voltage	10V ±3%, max. 10 mA
Analog current, output	0 (4) – 20 mA, $R_L = 500$ kΩ, resolution 10 bit, accuracy ≤ ±2%
Relay output Max. switching voltage Max. switching load Max. continuous load	 300V DC, 250V AC 8A/24V DC, .4A/300V DC, 2 kVA/250V AC 2A rms
Thermistor input	$R_{trip} = 4.7$ kΩ

Table 40-57. Option Board Kits

Option Kit Description ②	Allowed Slot Locations ①	Field Installed		Factory Installed		SLX9000 Programs
		Catalog Number	Price U.S. $	Option Designator	Adder U.S. $	
Extended I/O Card Options						
3 DI, 1 RO (NO/NC), 1 DO	**D**	**OPTAA**		**AA**		X
3 DI, 1 RO (NO), 1 TI	**D**	**OPTAI**		**AI**		X
1 RO (NC/NO), 1 RO (NO), 1 Therm	**D**, E	**OPTB2**		**B2**		X
1 AI (mA isolated), 2 AO (mA isolated), 1 ext +24V DC/EXT +24V DC	**D**, E	**OPTB4**		**B4**		X
3 RO (NO)	**D**, E	**OPTB5**		**B5**		X
Communication Cards						
Johnson Controls N2	D, **E**	**OPTC2**		**CA**		X
Modbus	D, **E**	**OPTC2**	.	**C2**		X
Modbus TCP	D, **E**	**OPTCI**		**CI**		X
BACnet	D, **E**	**OPTCJ**		**CJ**		X
Profibus DP	D, **E**	**OPTC3**		**C3**		X
LonWorks	D, **E**	**OPTC4**		**C4**		X
Profibus DP (D9 Connector)	D, **E**	**OPTC5**		**C5**		X
CanOpen (Slave)	D, **E**	**OPTC6**		**C6**		X
DeviceNet	D, **E**	**OPTC7**		**C7**		X
Keypad						
SLX9000 Series LCD Keypad (Replacement Keypad)		**KEYPAD-LCD**		**—**		X
SLX9000 Series Remote Mount Keypad Unit (Keypad not included, includes 6.5 ft. cable, keypad holder, mounting hardware)		**OPTDRA-02L**		**—**		X

① Option card must be installed in one of the slots listed for that card. Slot indicated in **Bold** is the preferred location.
② AI = Analog Input; AO = Analog Output, DI = Digital Input, DO = Digital Output, RO = Relay Output

Discount Symbol **SS-3**

Johnson Controls Metasys™ N2 Network Communications

The OPTC2 fieldbus board provides communication between the SLX9000 drive and a Johnson Controls Metasys™ N2 network. With this connection, the drive can be controlled, monitored and programmed from the Metasys system. The N2 fieldbus is available as a factory installed option and as a field installable kit.

Modbus RTU Network Communications

The Modbus Network Card OPTC2 is used for connecting the 9000X Drive as a slave on a Modbus network. The interface is connected by a 9-pin DSUB connector (female) and the baud rate ranges from 300 to 19200 baud. Other communication parameters include an address range from 1 to 247; a parity of None, Odd or Even; and the stop bit is 1.

Modbus/TCP Network Communications

The Modbus/TCP Network Card OPTCI is used for connecting the 9000X Drive to Ethernet networks utilizing Modbus protocol. It includes an RJ-45 pluggable connector. This interface provides a selection of standard and custom register values to communicate drive parameters. The board supports 10 Mbps and 100 Mbps communication speeds. The IP address of the board is configurable over Ethernet using a supplied software tool.

BACnet Network Communications

The BACnet Network Card OPTCJ is used for connecting the 9000X Drive to BACnet networks. It includes a 5.08 mm pluggable connector. Data transfer is Master-Slave/Token Passing (MS/TP) RS-485. This interface uses a collection of 30 Binary Value Objects (BVOs) and 35 Analog Value Objects (AVOs) to communicate drive parameters. The card supports 9.6, 19.2 and 38.4 Kbaud communication speeds and supports network addresses 1 – 127.

Profibus Network Communications

The Profibus Network Card OPTC3 is used for connecting the SLX9000 as a slave on a Profibus-DP network. The interface is connected by a 9-pin DSUB connector (female). The baud rates range from 9.6K baud to 12M baud, and the addresses range from 1 to 127.

LonWorks Network Communications

The LonWorks Network Card OPTC4 is used for connecting the SLX9000 on a LonWorks network. This interface uses Standard Network Variable Types (SNVT) as data types. The channel connection is achieved using a FTT-10A Free Topology transceiver via a single twisted transfer cable. The communication speed with LonWorks is 78 kBits/s.

CanOpen (Slave) Communications

The CanOpen (Slave) Network Card OPTC6 is used for connecting the SLX9000 to a host system. According to ISO11898 standard cables to be chosen for CAN bus should have a nominal impedance of 120Ω, and specific line delay of nominal 5 nS/m. 120Ω line termination resistors required for installation.

DeviceNet Network Communications

The DeviceNet Network Card OPTC7 is used for connecting the SLX9000 on a DeviceNet Network. It includes a 5.08 mm pluggable connector. Transfer method is via CAN using a 2-wire twisted shielded cable with 2-wire bus power cable and drain. The baud rates used for communication include 125K baud, 250k baud and 500K baud.

Product Selection

When Ordering

- Select a Base Catalog Number that meets the application requirements — nominal horsepower, voltage and enclosure rating (the enclosed drive's continuous output amp rating should be equal to or greater than the motor's full load amp rating). The base enclosed package includes a standard drive, door mounted Local/Remote Keypad and enclosure.
- If Control/Communication option is desired, change the appropriate code in the Base Catalog Number.
- Select Enclosed Options. Add the codes as suffixes to the Base Catalog Number in alphabetical and numeric order.
- **Read all Footnotes.**

480V Drives

Table 40-58. 480V AC Input Base Drive

Enclosure Size ①	hp	Current (A)	NEMA Type 1			NEMA Type 12			NEMA Type 3R		
			Frame Size	Base Catalog Number ②	Price U.S. $	Frame Size	Base Catalog Number ②	Price U.S. $	Frame Size	Base Catalog Number ②	Price U.S. $
High Overload Drive and Enclosure											
MF0	1	2.2	MF4	**SLX00114EA**		MF4	**SLX00124EA**		MF4	**SLX00134EA**	
	1-1/2	3.3	MF4	**SLXF1514EA**		MF4	**SLXF1524EA**		MF4	**SLXF1534EA**	
	2	4.3	MF4	**SLX00214EA**		MF4	**SLX00224EA**		MF4	**SLX00234EA**	
	3	5.6	MF4	**SLX00314EA**		MF4	**SLX00324EA**		MF4	**SLX00334EA**	
	5	7.6	MF4	**SLX00514EA**		MF4	**SLX00524EA**		MF4	**SLX00534EA**	
MF1	7-1/2	12	MF5	**SLX00714EA**		MF5	**SLX00724EA**		MF5	**SLX00734EA**	
	10	16	MF5	**SLX01014EA**		MF5	**SLX01024EA**		MF5	**SLX01034EA**	
	15	23	MF5	**SLX01514EA**		MF5	**SLX01524EA**		MF5	**SLX01534EA**	
MF2	20	31	MF6	**SLX02014EA**		MF6	**SLX02024EA**		MF6	**SLX02034EA**	
	25	38	MF6	**SLX02514EA**		MF6	**SLX02524EA**		MF6	**SLX02534EA**	
	30	46	MF6	**SLX03014EA**		MF6	**SLX03024EA**		MF6	**SLX03034EA**	
Low Overload Drive and Enclosure											
MF0	1-1/2	3.3	MF4	**SLXF1514BA**		MF4	**SLXF1524BA**		MF4	**SLXF1534BA**	
	2	4.3	MF4	**SLX00214BA**		MF4	**SLX00224BA**		MF4	**SLX00234BA**	
	3	5.6	MF4	**SLX00314BA**		MF4	**SLX00324BA**		MF4	**SLX00334BA**	
	5	7.6	MF4	**SLX00514BA**		MF4	**SLX00524BA**		MF4	**SLX00534BA**	
	7-1/2	12	MF4	**SLX00714BA**		MF4	**SLX00724BA**		MF4	**SLX00734BA**	
MF1	10	16	MF5	**SLX01014BA**		MF5	**SLX01024BA**		MF5	**SLX01034BA**	
	15	23	MF5	**SLX01514BA**		MF5	**SLX01524BA**		MF5	**SLX01534BA**	
	20	31	MF5	**SLX02014BA**		MF5	**SLX02024BA**		MF5	**SLX02034BA**	
MF2	25	38	MF6	**SLX02514BA**		MF6	**SLX02524BA**		MF6	**SLX02534BA**	
	30	46	MF6	**SLX03014BA**		MF6	**SLX03024BA**		MF6	**SLX03034BA**	
	40	61	MF6	**SLX04014BA**		MF6	**SLX04024BA**		MF6	**SLX04034BA**	

① Enclosure dimensions listed on **Pages 40-44 – 40-48**.
② Includes drive, keypad and enclosure.

Discount Symbol **SS-3**

Table 40-59. 480V Control Options

Catalog Number Suffix ⇒	Door-Mounted Speed Potentiometer	Door-Mounted Speed Potentiometer with HOA Selector Switch	3 – 15 psig Follower	HAND/OFF/ AUTO Switch (22 mm)	MANUAL/AUTO Ref Switch (22 mm)	START/STOP Pushbuttons (22 mm)	115 Volt Control Transformer 150 VA	Standard Elapsed Time Meter
	K1	K2	K3	K4	K5	K6	KB	KO
hp	Adder U.S. $	Adder U.S. $	Adder U.S. $	Adder U.S. $	Adder U.S. $	Adder U.S. $	Adder U.S. $	Adder U.S. $
1 – 40								

Table 40-60. 480V Light Options

Catalog Number Suffix ⇒	Power On/Fault Pilot Lights (22 mm)	Green RUN Light (22 mm)	Green STOP Light (22 mm)	Red RUN Light (22 mm)	Red STOP Light (22 mm)	Power On Light (22 mm)	Misc Light (22 mm)
	L1	LA	LD	LE	LF	LJ	LU
hp	Adder U.S. $	Adder U.S. $	Adder U.S. $	Adder U.S. $	Adder U.S. $	Adder U.S. $	Adder U.S. $
1 – 40							

Table 40-61. 480V Bypass Options ①

Catalog Number Suffix ⇒	Bypass Test Switch for RA, RB	Bypass Pilot Lights for RA, RB Options	Dual Overloads for Bypass	Manual HOA Bypass Controller	Manual IOB Bypass Controller
	KF	L2	PN	RA	RB
hp	Adder U.S. $	Adder U.S. $	Adder U.S. $	Adder U.S. $	Adder U.S. $
1 – 20					
25					
30 40					

① See **Pages 40-40** and **40-41** for details.

Table 40-62. 480V Enclosure Options

Catalog Number Suffix ⇒	Space Heater ②
	S9
Enclosure Size	Adder U.S. $
MF0 – MF2	

② Requires customer supplied 115V AC supply.

Table 40-63. 480V Power Options

Catalog Number Suffix ⇒	Input				Output			
	Input Disconnect (HMCP) 100 kAIC	Input Line Fuses 200 kAIC	5% Input Reactance	Input Power Surge Protection	Output Contactor	Output Filter	Single Overload Relay ③	Dual Overload Relays ③
	P1	P3	P5	P7	PE	PF	PH	PI
hp	Adder U.S. $	Adder U.S. $	Adder U.S. $	Adder U.S. $	Adder U.S. $	Adder U.S. $	Adder U.S. $	Adder U.S. $
1 – 2 3 – 5 7-1/2								
10 15 20								
25								
30 40								

③ Heater packs not included.

Discount Symbol........................ **SS-2**

Dimensions

Enclosure Size MF0 without Filter

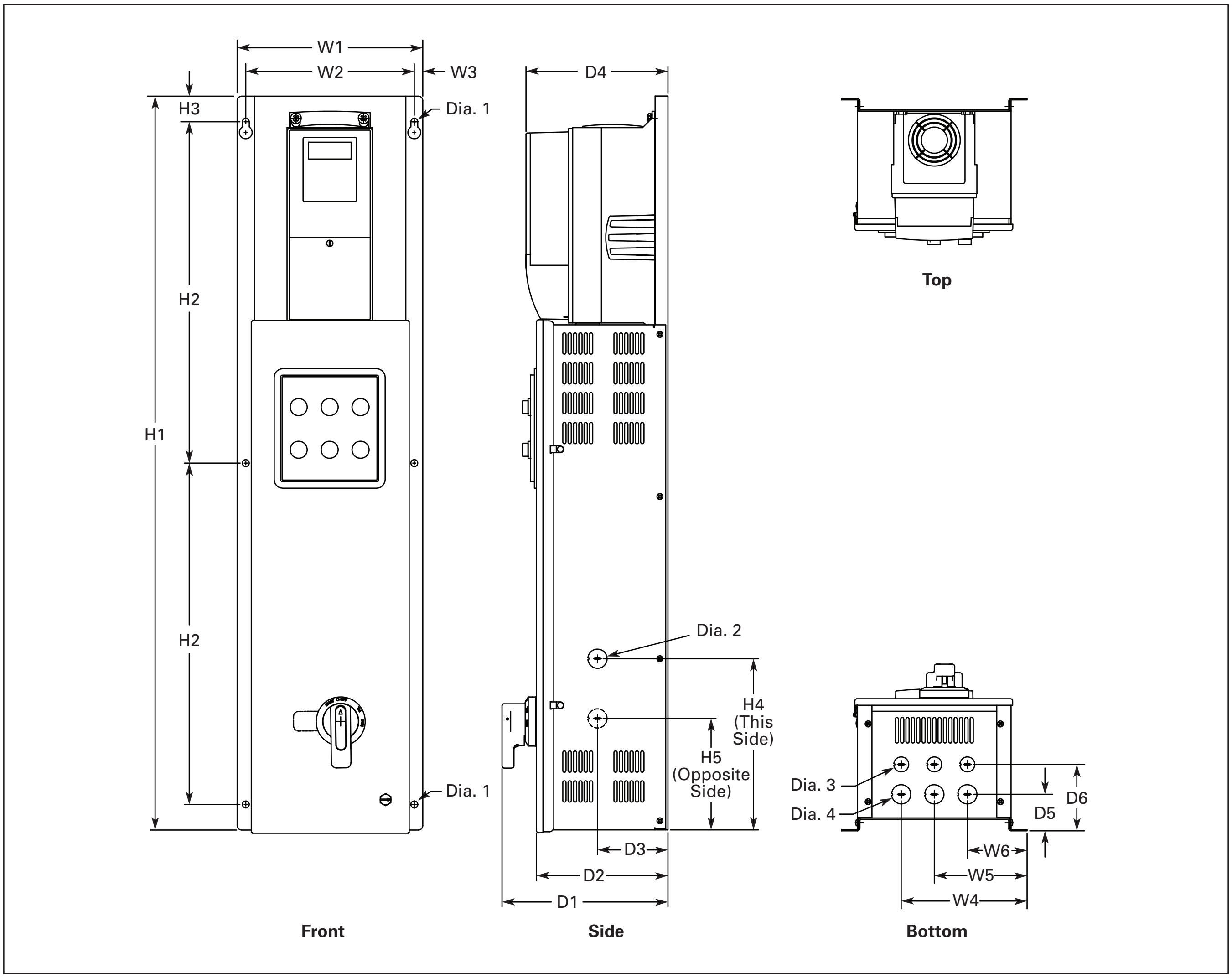


Figure 40-16. Approximate Dimensions

Table 40-64. Approximate Dimensions and Shipping Weight — Enclosed Products

Voltage AC	hp (I_H)	hp (I_L)	Approximate Dimensions in Inches (mm)										
			H1	H2	H3	H4	H5	W1	W2	W3	W4	W5	W6
480V	1 – 5	1-1/2 – 7-1/2	43.00 (1092)	20.00 (508)	1.50 (38)	10.03 (255)	6.53 (166)	10.88 (276)	9.87 (251)	.50 (13)	7.38 (187)	5.44 (138)	3.50 (89)

Table 40-64. Approximate Dimensions and Shipping Weight — Enclosed Products (Continued)

Voltage AC	hp (I_H)	hp (I_L)	Approximate Dimensions in Inches (mm)										Max. Approx. Wt. Lbs. (kg)
			D1	D2	D3	D4	D5	D6	Dia. 1	Dia. 2	Dia. 3	Dia. 4	
480V	1 – 5	1-1/2 – 7-1/2	9.72 (247)	7.70 (195)	4.13 (105)	8.31 (211)	3.89 (99)	2.14 (54)	.41 (10)	1.12 (29)	.88 (22)	1.13 (29)	49 (22)

Enclosure Size MF0 with Filter

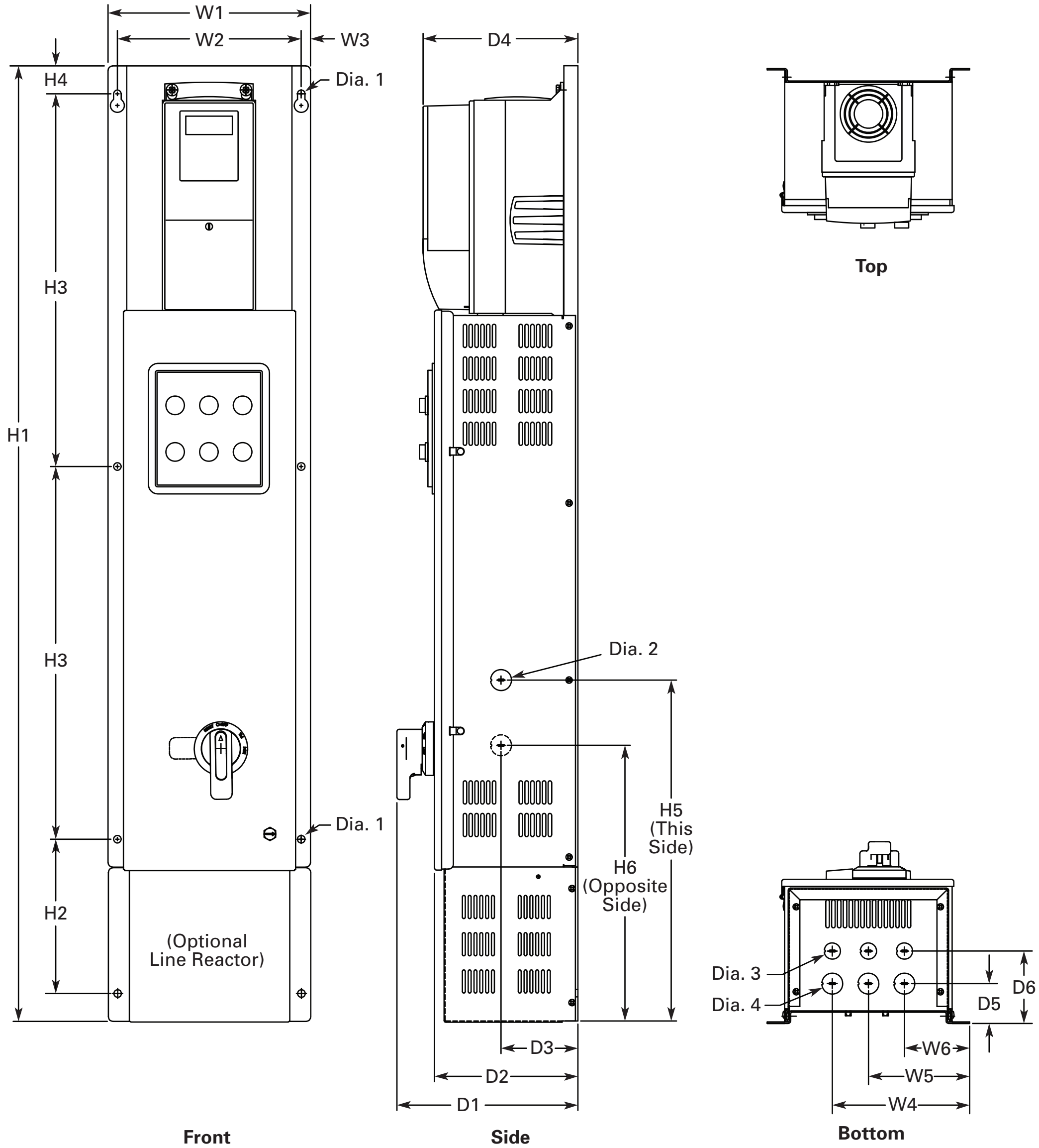


Figure 40-17. Approximate Dimensions

Table 40-65. Approximate Dimensions and Shipping Weight — Enclosed Products

Voltage AC	hp (I_H)	hp (I_L)	Approximate Dimensions in Inches (mm)											
			H1	H2	H3	H4	H5	H6	W1	W2	W3	W4	W5	W6
480V	1 – 5	1-1/2 – 7-1/2	51.28 (1303)	8.28 (210)	20.00 (508)	1.50 (38)	18.30 (465)	14.80 (378)	10.88 (276)	9.87 (251)	.50 (13)	7.38 (187)	5.44 (138)	3.50 (89)

Table 40-65. Approximate Dimensions and Shipping Weight — Enclosed Products (Continued)

Voltage AC	hp (I_H)	hp (I_L)	Approximate Dimensions in Inches (mm)										Max. Approx. Wt. Lbs. (kg)
			D1	D2	D3	D4	D5	D6	Dia. 1	Dia. 2	Dia. 3	Dia. 4	
480V	1 – 5	1-1/2 – 7-1/2	9.72 (247)	77.70 (195)	4.13 (105)	8.31 (211)	3.89 (99)	2.14 (54)	.41 (10)	1.12 (29)	.88 (22)	1.13 (29)	49 (22)

Enclosure Size MF1 without Filter

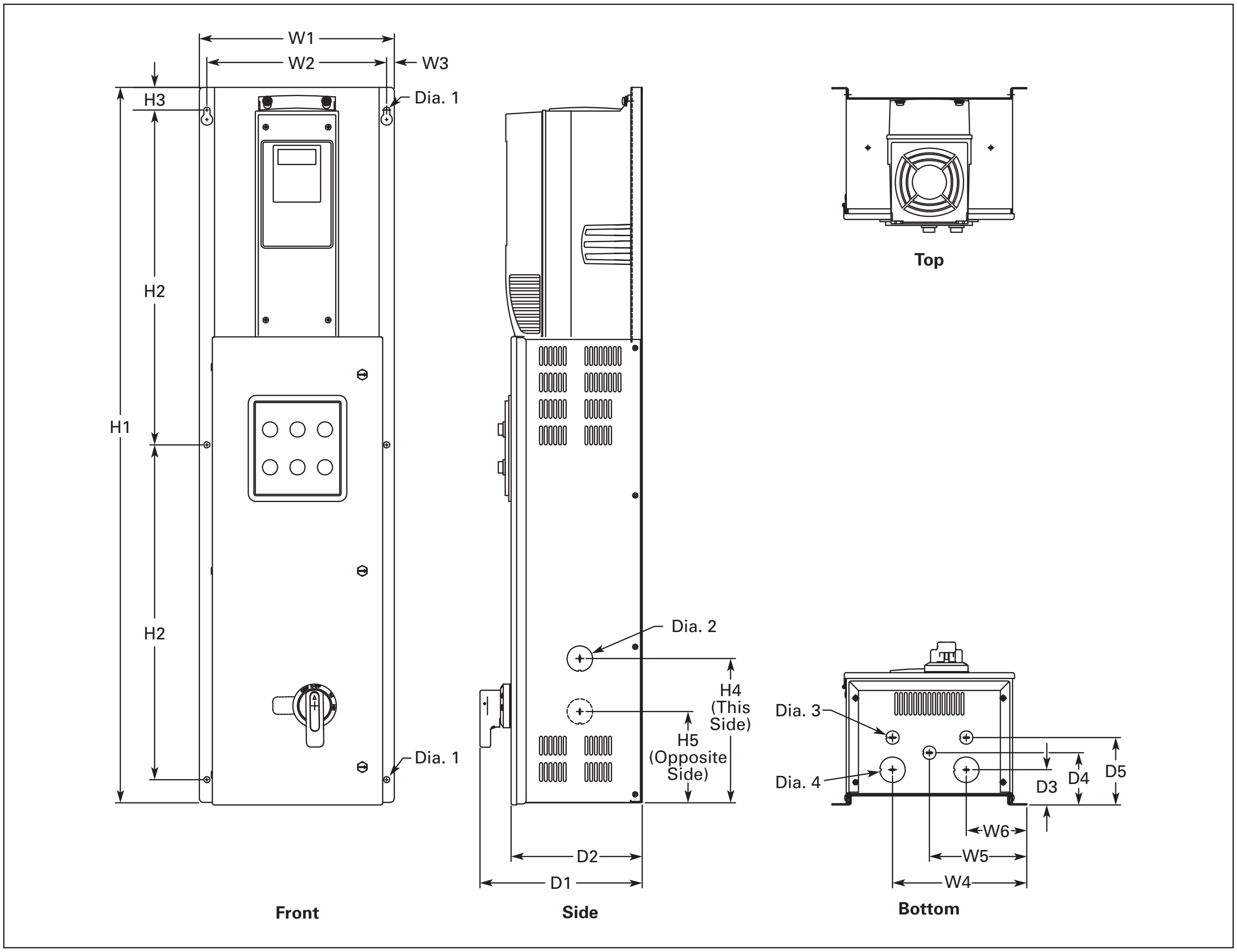


Figure 40-18. Approximate Dimensions

Table 40-66. Approximate Dimensions and Shipping Weight — Enclosed Products

Voltage AC	hp (I_H)	hp (I_L)	Approximate Dimensions in Inches (mm)										
			H1	H2	H3	H4	H5	W1	W2	W3	W4	W5	W6
480V	7-1/2 – 15	10 – 20	47.25 (1200)	22.13 (562)	1.50 (38)	9.50 (241)	6.00 (152)	12.87 (327)	11.87 (302)	.50 (13)	8.88 (225)	6.44 (164)	4.00 (102)

Table 40-66. Approximate Dimensions and Shipping Weight — Enclosed Products (Continued)

Voltage AC	hp (I_H)	hp (I_L)	Approximate Dimensions in Inches (mm)									Max. Approx. Wt. Lbs. (kg)
			D1	D2	D3	D4	D5	Dia. 1	Dia. 2	Dia. 3	Dia. 4	
480V	7-1/2 – 15	10 – 20	10.72 (272)	8.67 (220)	2.51 (64)	3.64 (92)	4.64 (118)	.41 (10)	1.69 (43)	.88 (22)	1.69 (43)	67 (30)

Enclosure Size MF1 with Filter

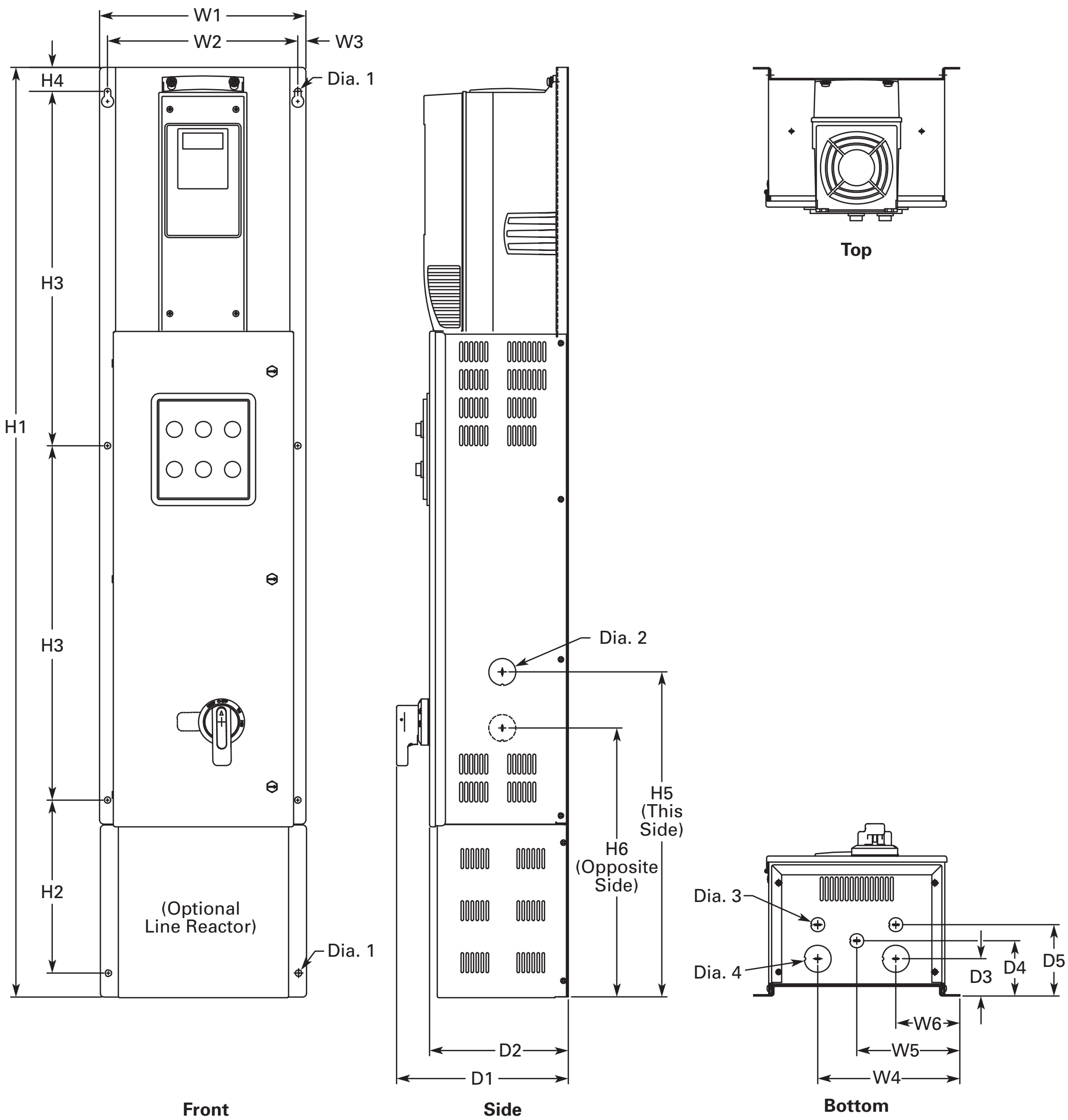


Figure 40-19. Approximate Dimensions

Table 40-67. Approximate Dimensions and Shipping Weight — Enclosed Products

Voltage AC	hp (I_H)	hp (I_L)	Approximate Dimensions in Inches (mm)											
			H1	H2	H3	H4	H5	H6	W1	W2	W3	W4	W5	W6
480V	7-1/2 – 15	10 – 20	58.05 (1475)	10.80 (274)	22.13 (562)	1.50 (38)	20.28 (515)	16.78 (426)	12.87 (327)	11.87 (302)	.50 (13)	8.88 (225)	6.44 (164)	4.00 (102)

Table 40-67. Approximate Dimensions and Shipping Weight — Enclosed Products (Continued)

Voltage AC	hp (I_H)	hp (I_L)	Approximate Dimensions in Inches (mm)									Max. Approx. Wt. Lbs. (kg)
			D1	D2	D3	D4	D5	Dia. 1	Dia. 2	Dia. 3	Dia. 4	
480V	7-1/2 – 15	10 – 20	10.72 (272)	8.67 (220)	2.32 (59)	3.45 (88)	4.45 (113)	.41 (10)	1.69 (43)	.88 (22)	1.69 (43)	67 (30)

40

Enclosure Size MF2

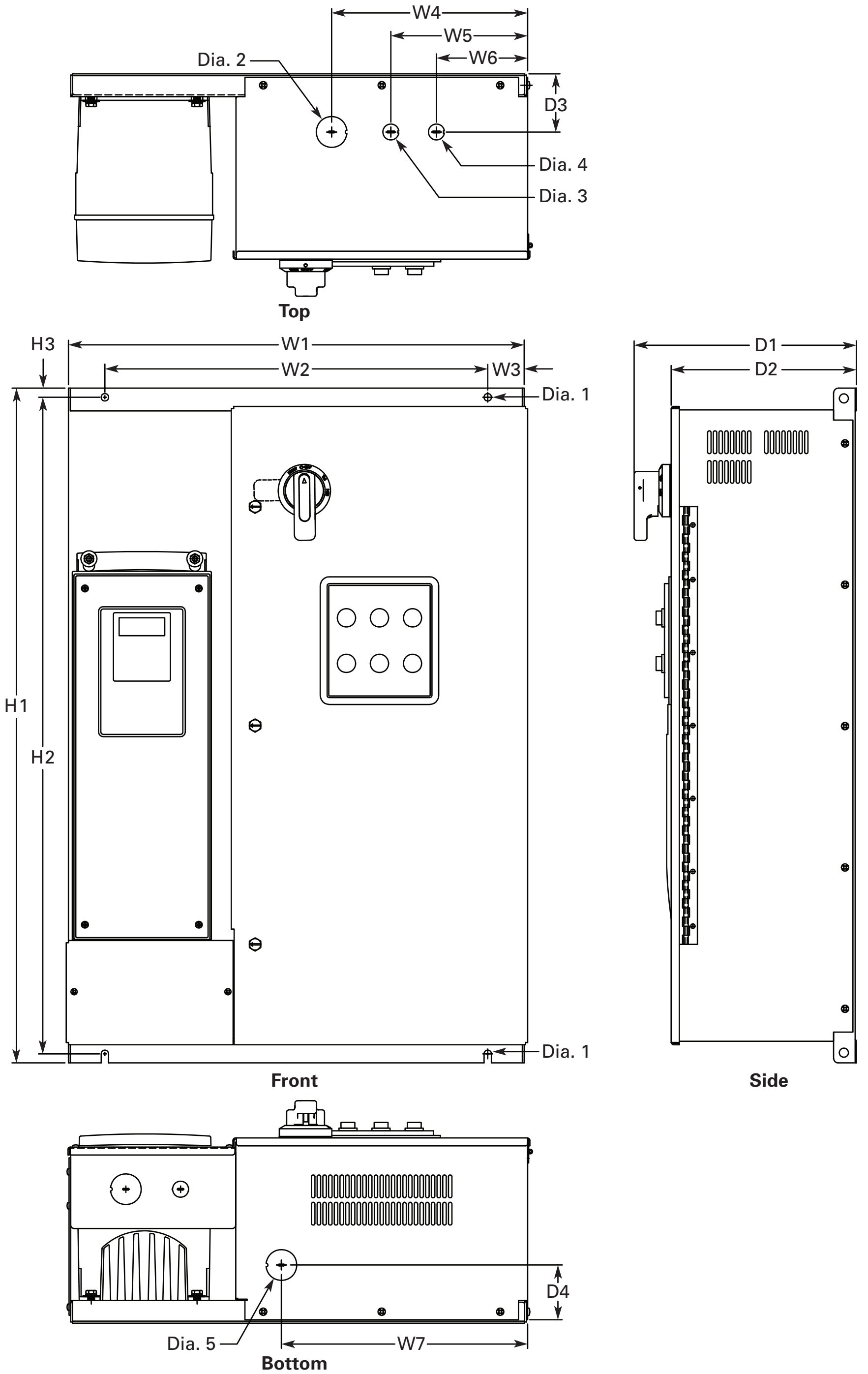


Figure 40-20. Approximate Dimensions

Table 40-68. Approximate Dimensions and Shipping Weight — Enclosed Products

Voltage AC	hp (I_H)	hp (I_L)	Approximate Dimensions in Inches (mm)																	Max. Approx. Wt. Lbs. (kg)
			H1	H2	H3	W1	W2	W3	W4	W5	W6	W7	D1	D2	D3	D4	Dia. 1	Dia. 2	Dia. 3	Dia. 4	Dia. 5	
480V	20 – 30	25 – 40	37.00 (940)	36.00 (914)	.50 (13)	25.00 (635)	21.00 (533)	2.00 (51)	10.69 (271)	7.44 (189)	4.94 (125)	13.44 (341)	12.19 (310)	10.16 (258)	3.19 (81)	3.12 (79)	.41 (10)	1.69 (43)	.87 (22)	.88 (22)	1.69 (43)	126 (57)

Contents

Overview

With the SVX9000 series sensorless vector control, Eaton's expanded Cutler-Hammer® drive offering now covers a complete line of PWM adjustable frequency (speed) drives in ratings from:

- 208V — 3/4 to 100 hp I_H; 1 to 100 hp I_L
- 230V — 3/4 to 100 hp I_H; 1 to 100 hp I_L
- 480V — 1 to 1900 hp I_H; 1-1/2 to 2200 hp I_L
- 575V — 2 to 2000 hp I_H; 3 to 2300 hp I_L

The 9000X Family of Drives includes HVX9000, SVX9000, SLX9000 and SPX9000 drives. 9000X Series drive ratings are rated for either high overload (I_H) or low overload (I_L). I_L indicates 110% overload capacity for 1 minute out of 10 minutes. I_H indicates 150% overload capacity for 1 minute out of 10 minutes.

A full range of enclosure types and options are available to meet a wide array of applications — from simple variable torque to more complex industrial applications such as conveyors, mixers and machine controls.

Application Description

Application Engineering

Proper selection and application of all drive system components is essential to assure that an adjustable frequency drive system will safely and reliably provide the performance required for any given application. The party responsible for the overall design and operation of the facility must make sure that qualified personnel are employed to select all components of the drive system, including appropriate safety devices. Eaton's Cutler-Hammer AF Drives Application Engineering Department is prepared to provide assistance to answer any questions about the technical capabilities of Cutler-Hammer drives.

Motor Selection

The basic requirement of motor selection is to match the torque vs. speed capability of the motor to the torque vs. speed requirement of the driven load.

Motor Torque vs. Speed Capability

As the speed of a motor is reduced below its 60 Hz base speed, motor cooling becomes less effective because of the reduced speed of the self-cooling fan. This limitation determines the maximum torque for continuous operation at any operating speed. The maximum intermittent operating torque is determined by the motor's torque vs. current characteristics and the output current capability of the adjustable frequency controller.

Multiple Motor Operation

A number of motors can be connected in parallel to a single controller. Since the frequency of the power supplied by the controller is the same for each motor, the motors will always operate at the same speed. Application Engineering assistance must be requested for all multiple motor applications to assure compliance with all controller design limitations.

Special Types of Motors

Standard NEMA Designs A and B three-phase motors are the only motors recommended for use in the majority of applications, but other types of motors are occasionally used. If the existing motor used in the application or the motor proposed for use with the drive system is a type other than NEMA Design A or B, Application Engineering assistance must be requested to make certain that the drive is properly applied.

Controller Selection

The basic requirement of controller selection is to match the output current, voltage and frequency capabilities of the controller with the requirements of the connected motor.

Output Current

The controller must be selected and applied such that the average operating motor current and horsepower do not exceed the continuous current and horsepower ratings of the controller. The intermittent operating current must not exceed the intermittent current rating of the controller.

Motor Protection

Cutler-Hammer adjustable frequency drives include electronic motor overload protection circuits that are designed to meet the requirements of NEC article 430-2 provided that only one motor is connected to the output of the controller.

Output Voltage and Frequency

When they are shipped, AF controllers are adjusted to provide a maximum output voltage and frequency equivalent to the input line voltage and frequency. The controllers can be adjusted to operate above line frequency, but a hazard of personal injury or equipment damage may exist when the motor is operated above base speed. Before adjusting the drive to operate above line frequency, make sure that the motor and the driven machinery can safely be operated at the resulting speed.

Controller Features

Operator Control and Interface Requirements

Since there are many possible configurations and many ways of achieving a specific end result, it pays to consider the operator control and interface requirements carefully. A simplified and more economical drive package can often be achieved by selecting from standard product offerings rather than specifying a custom designed configuration.

Installation Compatibility

The successful application of an AC drive requires the assurance that the drive will be compatible with the environment in which it will be installed. In planning the installation, be sure to carefully consider the heat produced by the drive, the altitude and temperature limits and the need for clean cooling air. Other important considerations include acoustical noise, vibration, electromagnetic compatibility, power quality, controller input harmonic current and power distribution equipment requirements.

Auxiliary Equipment and Accessories

Adjustable drives are generally designed to have a motor directly connected to the controller output terminals with no other equipment connected in series or parallel. Motor starters, disconnect switches, surge absorbers, dv/dt suppression circuits, output chokes, output transformers and any other equipment under consideration for installation on the output of the controller should not be installed without first requesting Application Engineering assistance. Power factor correction capacitors must never, under any circumstances, be connected at the output of the controller. They would serve no useful purpose, and they may damage the controller.

Enclosure Definitions

- **NEMA Type 1** — Enclosures are intended for indoor use primarily to provide a degree of protection against contact with enclosed equipment and provide a degree of protection against a limited amount of falling dirt in locations where unusual service conditions do not exist. Top or side openings in the NEMA Type 1 enclosure allow for the free exchange of inside and outside air while meeting the UL rod entry and rust resistance design tests.
- **NEMA Type 12** — Enclosures are intended for indoor use primarily to provide a degree of protection against circulating dust, falling dirt and dripping noncorrosive liquids. To meet UL drip, dust and rust resistance tests, NEMA Type 12 enclosures have no openings to allow for the exchange of inside and outside air.
- **Chassis IP00** — Similar to Protected Chassis IP20 except power terminals are protected by plastic shielding only. Primarily intended to be mounted inside a surrounding protective enclosure.
- **NEMA 3R** — Similar in design to NEMA Type 12 except with more stringent design and test requirements.

Motor Protection

DV/DT and Peak Motor Voltage Solutions

Today's AFD products offer significantly improved performance, but at the potential cost of motor insulation stress. The fast switching time of the IGBT devices used in newer AFDs can cause a transmission line effect in the output power leads to the motor, leading to possibly damaging voltage levels. To meet this need, NEMA has introduced a motor in MG1, Part 31, which provides an insulation system designed to maintain normal motor life in AFD applications. For existing motors, a motor protection scheme is required for longer cable runs. Eaton offers three standard solutions for existing systems.

- **MotoR$_X$**
  This patented Cutler-Hammer solution provides an energy recovery system which clamps the peak motor voltage to a safe level for standard motors. This option is used when the distance between a single motor and the drive is 600 feet or less.
- **Output Line Reactor**
  This option provides an output line reactor, reducing the DV/DT of the AFD output voltage and lessening the transmission line effect, to lower the peak voltage at the motor terminals.

Product Availability Codes

The product availability codes indicate the type of facility (warehouse, Mod Center or factory) that the product will ship from and, if it is not in stock, the number of working days needed to assemble the product from receipt of the order to shipment from the designated facility. Please note that this lead-time does not include any in-transit time from our facility to your facility.

Table 40-69. Product Availability Codes

Codes	Description
W	Warehouse stocked item. Shipped on customer request date. If item is backordered, please check Vista/VISTALINE or contact your Customer Support Center for product availability.
F1	Factory assemble-to-order. Shipped from factory within 1 working day after receipt of order on Vista.
FA	Factory assemble-to-order. Shipped from factory within 2 – 3 working days after receipt of order on Vista.
FB	Factory assemble-to-order. Shipped from factory within 4 – 10 working days after receipt of order on Vista.
FC	Factory assemble-to-order. Shipped from factory within 11 – 15 working days after receipt of order on Vista.
FD	Factory assemble-to-order. Shipped from factory within 16 – 20 working days after receipt of order on Vista.
FP	Factory assemble-to-order. Shipped from factory on negotiated promise date.
MA	Mod Center assemble-to-order. Shipped from Mod Center within 1 – 3 working days after receipt of order on Vista.
MB	Mod Center assemble-to-order. Shipped from Mod Center within 4 – 10 working days after receipt of order on Vista.
MP	Mod Center assemble-to-order. Shipped from Mod Center on negotiated promise date.

Product availability codes contained herein for a given product may be quantity sensitive and are subject to change without notice. For the most current information, refer to the Product Identification Inquiry (PIN) screen on Vista.

SVX9000 Open Drives



SVX9000 Open Drives

Product Description

Cutler-Hammer® SVX9000 Series Adjustable Frequency Drives from Eaton's electrical business are the next generation of drives specifically engineered for today's commercial and industrial applications. The power unit makes use of the most sophisticated semiconductor technology and a highly modular construction that can be flexibly adapted to the customer's needs.

The input and output configuration (I/O) is designed with modularity in mind. The I/O is compromised of option cards, each with its own input and output configuration. The control module is designed to accept a total of five of these cards. The cards contain not only normal analog and digital inputs but also fieldbus cards.

These drives continue the tradition of robust performance, and raise the bar on features and functionality, ensuring the best solution at the right price.

Features

- Robust design — proven 500,000 hours MTBF
- Integrated 3% line reactors standard on drives from FR4 through FR9
- EMI/RFI Filters H standard up to 200 hp I_H 480V, 100 hp I_H 230V
- Simplified operating menu allows for typical programming changes, while programming mode provides control of everything
- Quick Start Wizard built into the programming of the drive ensures a smooth start-up
- Keypad can display up to three monitored parameters simultaneously
- LOCAL/REMOTE operation from keypad
- Copy/Paste function allows transfer of parameter settings from one drive to the next
- Standard NEMA Type 12 keypad on all drives
- The SVX can be flexibly adapted to a variety of needs using our pre-installed "Seven in One" Precision application programs consisting of:
  - ❑ Basic
  - ❑ Standard
  - ❑ Local/Remote
  - ❑ Multi Step Speed Control
  - ❑ PID Control
  - ❑ Multi-Purpose Control
  - ❑ Pump and Fan Control with Auto Change
- Additional I/O and communication cards provide plug and play functionality
- I/O connections with simple quick connection terminals
- UL Listed
- Hand-Held Auxiliary 240 Power Supply allows programming/monitoring of control module without applying full power to the drive
- Control logic can be powered from an external auxiliary control panel, internal drive functions and fieldbus if necessary
- Brake Chopper standard from:
  1 – 30 hp/380 – 500V
  3/4 – 15 hp/208 – 230V
- NEMA Type 1 and NEMA Type 12 enclosures available, Frame Sizes FR4 – FR9
- Open Chassis FR10 and greater
- NEMA Type 1 and NEMA Type 12 available in FR10 Freestanding design; NEMA Type 1 available in FR11 Freestanding design
- Standard option board configuration includes an A9 I/O board and an A2 relay output board installed in slots A and B

Technical Data and Specifications

Table 40-70. SVX9000 Specifications

Description	Specification
Input Ratings	
Input Voltage (V_{in})	+10% / -15%
Input Frequency (f_{in})	50/60 Hz (variation up to 45 – 66 Hz)
Connection to Power	Once per minute or less (typical operation)
High Withstand Rating	100 kAIC
Output Ratings	
Output Voltage	0 to V_{in}
Continuous Output Current	I_H rated 100% at 122°F (50°C), FR9 and below I_L rated 100% at 104°F (40°C), FR9 and below I_H/I_L 100% at 104°F (40°C), FR10 and above
Overload Current (I_H/I_L)	150% I_H, 110% I_L for 1 min.
Output Frequency	0 to 320 Hz
Frequency Resolution	.01 Hz
Initial Output Current (I_H)	250% for 2 seconds
Control Characteristics	
Control Method	Frequency Control (V/f) Open Loop: Sensorless Vector Control, Closed Loop: SPX9000 Drives Only
Switching Frequency Frame 4 – 6 Frame 7 – 12	Adjustable with Parameter 2.6.9 1 to 16 kHz; default 10 kHz 1 to 10 kHz; default 3.6 kHz
Frequency Reference	Analog Input: Resolution .1% (10-bit), accuracy ± 1% V/Hz Panel Reference: Resolution .01 Hz
Field Weakening Point	30 to 320 Hz
Acceleration Time	0 to 3000 sec.
Deceleration Time	0 to 3000 sec.
Braking Torque	DC brake: 30% x T_n (without brake option)
Ambient Conditions	
Ambient Operating Temperature	14°F (-10°C), no frost to 122°F (+50°C) I_H (FR4 – FR9) 14°F (-10°C), no frost to 104°F (+40°C) I_H (FR10 and up) 14°F (-10°C), no frost to 104°F (+40°C) I_L (all frames)
Storage Temperature	-40°F (-40°C) to 158°F (70°C)
Relative Humidity	0 to 95% RH, noncondensing, non-corrosive, no dripping water
Air Quality	Chemical vapors: IEC 721-3-3, unit in operation, class 3C2; Mechanical particles: IEC 721-3-3, unit in operation, class 3S2
Altitude	100% load capacity (no derating) up to 3280 ft. (1000m); 1% derating for each 328 ft. (100m) above 3280 ft. (1000m); max. 9842 ft. (3000m)
Vibration	EN 50178, EN 60068-2-6; 5 to 50 Hz, Displacement amplitude 1 mm (peak) at 3 to 15.8 Hz, Max. acceleration amplitude 1G at 15.8 to 150 Hz
Shock	EN 50178, EN 60068-2-27 UPS Drop test (for applicable UPS weights) Storage and shipping: max. 15G, 11 ms (in package)
Enclosure Class	NEMA 1/IP21 or NEMA 12/IP54, Open Chassis/IP20

Description	Specification
Standards	
Product	IEC 61800-2
Safety	UL 508C
EMC (at default settings)	Immunity: Fulfills all EMC immunity requirements; Emissions: EN 61800-3, LEVEL H
Control Connections	
Analog Input Voltage	0 to 10V, R = 200 kΩ (-10 to 10V joystick control) Resolution .1%; accuracy ±1%
Analog Input Current	0(4) to 20 mA; R_i - 250Ω differential
Digital Inputs (6)	Positive or negative logic; 18 to 30V DC
Auxiliary Voltage	+24V ±15%, max. 250 mA
Output Reference Voltage	+10V +3%, max. load 10 mA
Analog Output	0(4) to 20 mA; R_L max. 500Ω; Resolution 10 bit; Accuracy ±2%
Digital Outputs	Open collector output, 50 mA/48V
Relay Outputs	2 programmable Form C relay outputs Switching capacity: 24V DC / 8A, 250V AC / 8A, 125V DC / 0.4A
Protections	
Overcurrent Protection	Trip limit 4.0 x I_H instantaneously
Overvoltage Protection	Yes
Undervoltage Protection	Yes
Earth Fault Protection	In case of earth fault in motor or motor cable, only the frequency converter is protected
Input Phase Supervision	Trips if any of the input phases are missing
Motor Phase Supervision	Trips if any of the output phases are missing
Overtemperature Protection	Yes
Motor Overload Protection	Yes
Motor Stall Protection	Yes
Motor Underload Protection	Yes
Short Circuit Protection	Yes (+24V and +10V Reference Voltages)

Table 40-71. Standard I/O Specifications

Description	Specification
6 – Digital Input Programmable	24V: "0" ≤ 10V, "1" ≥ 18V,R_i > 5 kΩ
2 – Analog Input Configurable w/Jumpers	Voltage: 0 – ±10V, R_i > 200 kΩ Current: 0 (4) – 20 mA, R_i = 250 kΩ
2 – Digital Output Programmable	Form C Relays 250V AC 2 Amp or 30V DC2 Amp resistive
1 – Digital Output Programmable	Open collector 48V DC 50 mA
1 – Analog Output Programmable Configurable w/Jumper	0 – 20 mA, R_L < 500 ohms, resolution 10 Bits/0.1%

Catalog Number Selection

Table 40-72. Adjustable Frequency Drive Catalog Numbering System

S V X 0 1 0 A 1 – 4 A 1 B 1 _ _ _ _ _ _

Product Family
SVX = Open Drives
SPX = Open Drives FR10 & greater

Horsepower Rating	
F07 = 3/4 hp	**800** = 800 hp
F15 = 1-1/2 hp	**900** = 900 hp
007 = 7-1/2 hp	**H10** = 1000 hp
010 = 10 hp	**H12** = 1200 hp
050 = 50 hp	**H13** = 1350 hp
125 = 125 hp	**H15** = 1500 hp
350 = 350 hp	**H16** = 1600 hp
700 = 700 hp	**H20** = 2000 hp

AFD Software Series
A = Standard Software

Enclosure ③④	
0 = Chassis	**2** = NEMA Type 12
1 = NEMA Type 1	

Voltage Rating
2 = 230 (208 – 240) V
4 = 480 (380 – 500) V
5 = 575 (525 – 690) V

Keypad
A = Alphanumeric

Input Options ①
1 = 3-phase, EMC H
2 = 3-phase, EMC N
4 = 3-phase, EMC L

Brake Chopper Options ②
N = No Brake Chopper Circuit
B = Internal Brake Chopper Circuit

Board Modifications
1 = Standard Boards
2 = Conformal (Varnished) Coating ⑤

Options
Options appear in alphabetical order.
Extended I/O Card Options
B1 = 6 DI, 1 ext +24V DC/EXT +24V DC
B2 = 1 RO (NC/NO), 1 RO (NO), 1 Therm
B4 = 1 AI (mA isolated), 2 AO (mA isolated), 1 ext +24V DC/EXT + 24V DC
B5 = 3 RO (NO)
B8 = 1 ext +24V DC/EXT +24V DC, 3 Pt100
B9 = 1 RO (NO), 5 DI 42 – 240V AC Input
Communication Cards
CA = Johnson Controls N2
CI = Modbus TCP
CJ = BACnet
CK = Ethernet IP
C2 = Modbus
C3 = Profibus DP
C4 = LonWorks
C5 = Profibus DP (D9 Connector)
C6 = CanOpen (Slave)
C7 = DeviceNet
C8 = Modbus (D9 Type Connector)
D3 = RS-232 with D9 Connection

① All 230V Drives and 480V Drives up to 200 hp (I_H) are only available with Input Option **1** (EMC Level H). 480V Drives 250 hp (I_H) or larger are available with Input Option **2** (EMC Level N). 480V Drives are available with Input Option **4** (EMC Level L). 575V Drives 200 hp (I_H) or larger are only available with Input Option **2**. 575V Drives up to 150 hp (I_H) are only available with Input Option **4** (EMC Level L).

② 480V Drives up to 30 hp (I_H) are only available with Brake Chopper Option **B**. 480V Drives 40 hp (I_H) or larger come standard with Brake Chopper Option **N**. 230V Drives up to 15 hp (I_H) are only available with Brake Chopper Option **B**. 230V Drives 20 hp or larger come standard with Brake Chopper Option **N**. All 575V Drives come standard without Brake Chopper Option (**N**). **Note:** N = No Brake Chopper.

③ 480V Drives 250 hp (I_H) and larger are available with enclosure style **0** (Chassis); 690V Drives 200 hp (I_H) and larger are available with enclosure style **0** (Chassis).

④ 480V and 690V FR10 Freestanding Drives are available with enclosure style **1** (NEMA Type 1) and enclosure style **2** (NEMA Type 12). FR11 Freestanding Drives only available with enclosure style **1** (NEMA Type 1).

⑤ Factory promise delivery. Consult Sales Office for availability.

Product Selection

230V SVX9000 Drives

Table 40-73. 208 – 240V, NEMA Type 1 Drive

Frame Size	Delivery Code	hp (I_H)	Current (I_H)	hp (I_L)	Current (I_L)	Catalog Number	Price U.S. $
FR4	W	3/4	3.7	1	4.8	SVXF07A1-2A1B1	
		1	4.8	1-1/2	6.6	SVX001A1-2A1B1	
		1-1/2	6.6	2	7.8	SVXF15A1-2A1B1	
		2	7.8	3	11	SVX002A1-2A1B1	
		3	11	—	12.5	SVX003A1-2A1B1	
FR5	W	—	12.5	5	17.5	SVX004A1-2A1B1	
		5	17.5	7-1/2	25	SVX005A1-2A1B1	
		7-1/2	25	10	31	SVX007A1-2A1B1	
FR6	W	10	31	15	48	SVX010A1-2A1B1	
		15	48	20	61	SVX015A1-2A1B1	
FR7	W	20	61	25	75	SVX020A1-2A1N1	
		25	75	30	88	SVX025A1-2A1N1	
		30	88	40	114	SVX030A1-2A1N1	
FR8	W	40	114	50	140	SVX040A1-2A1N1	
		50	140	60	170	SVX050A1-2A1N1	
		60	170	75	205	SVX060A1-2A1N1	
FR9	W	75	205	100	261	SVX075A1-2A1N1	
		100	261	—	—	SVX100A1-2A1N1	

Table 40-74. 208 – 240V, NEMA Type 12 Drive

Frame Size	Delivery Code	hp (I_H)	Current (I_H)	hp (I_L)	Current (I_L)	Catalog Number	Price U.S. $
FR4	F1	3/4	3.7	1	4.8	SVXF07A2-2A1B1	
		1	4.8	1-1/2	6.6	SVX001A2-2A1B1	
		1-1/2	6.6	2	7.8	SVXF15A2-2A1B1	
		2	7.8	3	11	SVX002A2-2A1B1	
		3	11	—	12.5	SVX003A2-2A1B1	
FR5	F1	—	12.5	5	17.5	SVX004A2-2A1B1	
		5	17.5	7-1/2	25	SVX005A2-2A1B1	
		7-1/2	25	10	31	SVX007A2-2A1B1	
FR6	F1	10	31	15	48	SVX010A2-2A1B1	
		15	48	20	61	SVX015A2-2A1B1	
FR7	W	20	61	25	75	SVX020A2-2A1N1	
		25	75	30	88	SVX025A2-2A1N1	
		30	88	40	114	SVX030A2-2A1N1	
FR8	FP	40	114	50	140	SVX040A2-2A1N1	
		50	140	60	170	SVX050A2-2A1N1	
		60	170	75	205	SVX060A2-2A1N1	
FR9	FP	75	205	100	261	SVX075A2-2A1N1	
		100	261	—	—	SVX100A2-2A1N1	

480V SVX9000 Drives

Table 40-75. 380 – 500V, NEMA Type 1 Drive

Frame Size	Delivery Code	hp (I_H)	Current (I_H)	hp (I_L)	Current (I_L)	Catalog Number	Price U.S. $
FR4	W	1	2.2	1-1/2	3.3	SVX001A1-4A1B1	
		1-1/2	3.3	2	4.3	SVXF15A1-4A1B1	
		2	4.3	3	5.6	SVX002A1-4A1B1	
		3	5.6	5	7.6	SVX003A1-4A1B1	
		5	7.6	—	9	SVX005A1-4A1B1	
		—	9	7-1/2	12	SVX006A1-4A1B1	
FR5	W	7-1/2	12	10	16	SVX007A1-4A1B1	
		10	16	15	23	SVX010A1-4A1B1	
		15	23	20	31	SVX015A1-4A1B1	
FR6	W	20	31	25	38	SVX020A1-4A1B1	
		25	38	30	46	SVX025A1-4A1B1	
		30	46	40	61	SVX030A1-4A1B1	
FR7	W	40	61	50	72	SVX040A1-4A1N1	
		50	72	60	87	SVX050A1-4A1N1	
		60	87	75	105	SVX060A1-4A1N1	
FR8	W	75	105	100	140	SVX075A1-4A1N1	
		100	140	125	170	SVX100A1-4A1N1	
		125	170	150	205	SVX125A1-4A1N1	
FR9	W	150	205	200	261	SVX150A1-4A1N1	
		200	245	250	300	SVX200A1-4A1N1	

Discount Symbol **SS-2**

Table 40-76. 380 – 500V, NEMA Type 1 Freestanding Drive

Frame Size	Delivery Code	hp (I_H)	Current (I_H)	hp (I_L)	Current (I_L)	Catalog Number	Price U.S. $
FR10	W	250	330	300	385	**SPX250A1-4A4N1**	
	FP	300	385	350	460	**SPX300A1-4A4N1**	
	W	350	460	400	520	**SPX350A1-4A4N1**	
FR11	FP	400	520	500	590	**SPX400A1-4A4N1**	
	FP	500	590	550	650	**SPX500A1-4A4N1**	
	FP	550	650	600	730	**SPX550A1-4A4N1**	

Note: Integrated fuses as standard. Limited option selection available; 115V Transformer (KB), Light Kit (L1), HOA (K4), Speed Potentiometer w/HOA (K2), Disconnect Switch (P2). See Enclosed 480V option selection.

Table 40-77. 380 – 500V, NEMA Type 12 Drive

Frame Size	Delivery Code	hp (I_H)	Current (I_H)	hp (I_L)	Current (I_L)	Catalog Number	Price U.S. $
FR4	F1	1	2.2	1-1/2	3.3	**SVX001A2-4A1B1**	
		1-1/2	3.3	2	4.3	**SVXF15A2-4A1B1**	
		2	4.3	3	5.6	**SVX002A2-4A1B1**	
		3	5.6	5	7.6	**SVX003A2-4A1B1**	
		5	7.6	—	9	**SVX005A2-4A1B1**	
		—	9	7-1/2	12	**SVX006A2-4A1B1**	
FR5	F1	7-1/2	12	10	16	**SVX007A2-4A1B1**	
		10	16	15	23	**SVX010A2-4A1B1**	
		15	23	20	31	**SVX015A2-4A1B1**	
FR6	F1	20	31	25	38	**SVX020A2-4A1B1**	
		25	38	30	46	**SVX025A2-4A1B1**	
		30	46	40	61	**SVX030A2-4A1B1**	
FR7	W	40	61	50	72	**SVX040A2-4A1N1**	
		50	72	60	87	**SVX050A2-4A1N1**	
		60	87	75	105	**SVX060A2-4A1N1**	
FR8	W	75	105	100	140	**SVX075A2-4A1N1**	
		100	140	125	170	**SVX100A2-4A1N1**	
		125	170	150	205	**SVX125A2-4A1N1**	
FR9	W	150	205	200	261	**SVX150A2-4A1N1**	
		200	245	250	300	**SVX200A2-4A1N1**	

Table 40-78. 380 – 500V, NEMA Type 12 Freestanding Drive

Frame Size	Delivery Code	hp (I_H)	Current (I_H)	hp (I_L)	Current (I_L)	Catalog Number	Price U.S. $
FR10	FP	250	330	300	385	**SPX250A2-4A4N1**	
	FP	300	385	350	460	**SPX300A2-4A4N1**	
	FP	350	460	400	520	**SPX350A2-4A4N1**	

Note: Integrated fuses as standard. Limited option selection available; 115V Transformer (KB), Light Kit (L1), HOA (K4), Speed Potentiometer w/HOA (K2), Disconnect Switch (P2). See Enclosed 480V option selection.

Table 40-79. 480V 380 – 500, Open Chassis Drive

Frame Size	Delivery Code	hp (I_H)	Current (I_H)	hp (I_L)	Current (I_L)	Catalog Number	Price U.S. $
FR10 ①	W	250	330	300	385	**SPX250A0-4A2N1**	
		300	385	350	460	**SPX300A0-4A2N1**	
		350	460	400	520	**SPX350A0-4A2N1**	
FR11	W	400	520	500	590	**SPX400A0-4A2N1**	
		500	590	—	650	**SPX500A0-4A2N1**	
		—	650	600	730	**SPX550A0-4A2N1**	
FR12	FP	600	730	—	820	**SPX600A0-4A2N1**	
	W	—	820	700	920	**SPX650A0-4A2N1**	
	FP	700	920	800	1030	**SPX700A0-4A2N1**	
FR13	FP	800	1030	900	1150	**SPX800A0-4A2N1**	
		900	1150	1000	1300	**SPX900A0-4A2N1**	
		1000	1300	1200	1450	**SPXH10A0-4A2N1**	
FR14	FP	1200	1600	1500	1770	**SPXH12A0-4A2N1**	
		1600	1940	1800	2150	**SPXH16A0-4A2N1**	
		1900	2300	2200	2700	**SPXH19A0-4A2N1**	

① FR10 – FR14 includes 3% line reactor, but it is not integral to chassis.

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Discount Symbol **SS-2**

575V SVX9000 Drives

Table 40-80. 525 – 690V, NEMA Type 1 Drive

Frame Size	Delivery Code	hp (I_H)	Current (I_H)	hp (I_L)	Current (I_L)	Catalog Number	Price U.S. $
FR6	W	2 3 — 5 7-1/2 10 15 20 25	3.33 4.5 5.5 7.5 10 13.5 18 22 27	3 — 5 7-1/2 10 15 20 25 30	4.5 5.5 7.5 10 13.5 18 22 27 34	**SVX002A1-5A4N1** **SVX003A1-5A4N1** **SVX004A1-5A4N1** **SVX005A1-5A4N1** **SVX007A1-5A4N1** **SVX010A1-5A4N1** **SVX015A1-5A4N1** **SVX020A1-5A4N1** **SVX025A1-5A4N1**	
FR7	W	30 40	34 41	40 50	41 52	**SVX030A1-5A4N1** **SVX040A1-5A4N1**	
FR8	W	50 60 75	52 62 80	60 75 100	62 80 100	**SVX050A1-5A4N1** **SVX060A1-5A4N1** **SVX075A1-5A4N1**	
FR9	W	100 125 150 —	100 125 144 170	125 150 — 200	125 144 170 208	**SVX100A1-5A4N1** **SVX125A1-5A4N1** **SVX150A1-5A4N1** **SVX175A1-5A4N1**	

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Table 40-81. 525 – 690V, NEMA Type 1 Freestanding Drive

Frame Size	Delivery Code	hp (I_H)	Current (I_H)	hp (I_L)	Current (I_L)	Catalog Number	Price U.S. $
FR10	FP	200 250 300	208 261 325	250 300 400	261 325 385	**SPX200A1-5A4N1** **SPX250A1-5A4N1** **SPX300A1-5A4N1**	
FR11	FP	400 450 500	385 460 502	450 500 550	460 502 590	**SPX400A1-5A4N1** **SPX450A1-5A4N1** **SPX500A1-5A4N1**	

Note: Integrated fuses as standard. Limited option selection available; 115V Transformer (KB), Light Kit (L1), HOA (K4), Speed Potentiometer w/HOA (K2), Disconnect Switch (P2). See Enclosed 480V option selection.

Table 40-82. 525 – 690V, NEMA Type 12 Drive

Frame Size	Delivery Code	hp (I_H)	Current (I_H)	hp (I_L)	Current (I_L)	Catalog Number	Price U.S. $
FR6	F1	2 3 — 5 7-1/2 10 15 20 25	3.33 4.5 5.5 7.5 10 13.5 18 22 27	3 — 5 7-1/2 10 15 20 25 30	4.5 5.5 7.5 10 13.5 18 22 27 34	**SVX002A2-5A4N1** **SVX003A2-5A4N1** **SVX004A2-5A4N1** **SVX005A2-5A4N1** **SVX007A2-5A4N1** **SVX010A2-5A4N1** **SVX015A2-5A4N1** **SVX020A2-5A4N1** **SVX025A2-5A4N1**	
FR7	FP	30 40	34 41	40 50	41 52	**SVX030A2-5A4N1** **SVX040A2-5A4N1**	
FR8	FP	50 60 75	52 62 80	60 75 100	62 80 100	**SVX050A2-5A4N1** **SVX060A2-5A4N1** **SVX075A2-5A4N1**	
FR9	FP	100 125 150 —	100 125 144 170	125 150 — 200	125 144 170 208	**SVX100A2-5A4N1** **SVX125A2-5A4N1** **SVX150A2-5A4N1** **SVX175A2-5A4N1**	

Discount Symbol **SS-2**

Table 40-83. 525 – 690V, NEMA Type 12 Freestanding Drive

Frame Size	Delivery Code	hp (I_H)	Current (I_H)	hp (I_L)	Current (I_L)	Catalog Number	Price U.S. $
FR10	FP	200 250 300	208 261 325	250 300 400	261 325 385	**SPX200A2-5A4N1** **SPX250A2-5A4N1** **SPX300A2-5A4N1**	

Note: Integrated fuses as standard. Limited option selection available; 115V Transformer (KB), Light Kit (L1), HOA (K4), Speed Potentiometer w/HOA (K2), Disconnect Switch (P2). See Enclosed 480V option selection.

Table 40-84. 525 – 690V, Open Chassis Drive

Frame Size	Delivery Code	hp (I_H)	Current (I_H)	hp (I_L)	Current (I_L)	Catalog Number	Price U.S. $
FR10	FP	200 250 300	208 261 325	250 300 400	261 325 385	**SPX200A0-5A2N1** **SPX250A0-5A2N1** **SPX300A0-5A2N1**	
FR11	FP	400 450 500	385 460 502	450 500 —	460 502 590	**SPX400A0-5A2N1** **SPX450A0-5A2N1** **SPX500A0-5A2N1**	
FR12	FP	— 600 700	590 650 750	600 700 800	650 750 820	**SPX550A0-5A2N1** **SPX600A0-5A2N1** **SPX700A0-5A2N1**	
FR13	FP	800 900 1000	820 920 1030	900 1000 1250	920 1030 1180	**SPX800A0-5A2N1** **SPX900A0-5A2N1** **SPXH10A0-5A2N1**	
FR14	FP	1350 1500 2000	1300 1500 1900	1500 2000 2300	1500 1900 2250	**SPXH13A0-5A2N1** **SPXH15A0-5A2N1** **SPXH20A0-5A2N1**	

Discount Symbol........................ **SS-2**

June 2008

Open Drives

9000X Series Option Board Kits

The 9000X Series drives can accommodate a wide selection of expander and adapter option boards to customize the drive for your application needs. The drive's control unit is designed to accept a total of five option boards (see **Figure 40-21**).

The 9000X Series factory installed standard board configuration includes an A9 I/O board and an A2 relay output board, which are installed in slots A and B.

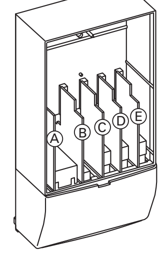


Figure 40-21. 9000X Series Option Boards

Table 40-85. Option Board Kits

Option Kit Description ②	Allowed Slot Locations ①	Field Installed		Factory Installed		SVX Ready Programs						
		Catalog Number	Price U.S. $	Option Designator	Adder U.S. $	Basic	Local/ Remote	Standard	MSS	PID	Multi-P.	PFC
Standard I/O Cards (See Figure 40-21)												
2 RO (NC/NO)	B	**OPTA2**		**—**		X	X	X	X	X	X	X
6 DI, 1 DO, 2 AI, 1AO, 1 +10V DC ref, 2 ext +24V DC/ EXT +24V DC	A	**OPTA9**		**—**		X	X	X	X	X	X	X
Extended I/O Card Options												
2 RO, Therm — SPX Only	B	**OPTA3**		**A3**		—	X	X	X	X	X	X
Encoder low volt +5V/15V/24V — SPX Only	C	**OPTA4**		**A4**		—	X	X	X	X	X	X
Encoder high volt +15V/24V — SPX Only	C	**OPTA5**		**A5**		—	X	X	X	X	X	X
Double encoder — SPX Only	C	**OPTA7**		**A7**		X	X	X	X	X	X	X
6 DI, 1 DO, 2 AI, 1 AO — SPX Only	A	**OPTA8**		**A8**		—	X	X	X	X	X	X
3 DI (Encoder 10 – 24V), Out +15V/+24V, 2 DO (pulse+direction) — SPX Only	C	**OPTAE**		**AE**		X	X	X	X	X	X	X
6 DI, 1 ext +24V DC/EXT +24V DC	B, C, **D**, E	**OPTB1**		**B1**		—	—	—	—	—	X	X
1 RO (NC/NO), 1 RO (NO), 1 Therm	B, C, **D**, E	**OPTB2**		**B2**		—	—	—	—	—	X	X
1 AI (mA isolated), 2 AO (mA isolated), 1 ext +24V DC/EXT +24V DC	B, C, **D**, E	**OPTB4**		**B4**		X	X	X	X	X	X	X
3 RO (NO)	B, C, **D**, E	**OPTB5**		**B5**		—	—	—	—	—	X	X
1 ext +24V DC/EXT +24V DC, 3 Pt100	B, C, **D**, E	**OPTB8**		**B8**		—	—	—	—	—	—	—
1 RO (NO), 5 DI 42 – 240V AC Input	B,C, **D**, E	**OPTB9**		**B9**		—	—	—	—	—	X	X
Communication Cards												
Modbus ③	D, **E**	**OPTC2**		**C2**		X	X	X	X	X	X	X
Johnson Controls N2 ③	D, **E**	**OPTC2**		**CA**		—	—	—	—	—	—	—
Modbus TCP	D, **E**	**OPTCI**		**CI**		X	X	X	X	X	X	X
BACnet	D, **E**	**OPTCJ**		**CJ**		X	X	X	X	X	X	X
Ethernet IP	D, **E**	**OPTCK**		**CK**		X	X	X	X	X	X	X
Profibus DP	D, **E**	**OPTC3**		**C3**		X	X	X	X	X	X	X
LonWorks	D, **E**	**OPTC4**		**C4**		X	X	X	X	X	X	X
Profibus DP (D9 Connector)	D, **E**	**OPTC5**		**C5**		X	X	X	X	X	X	X
CanOpen (Slave) ④	D, **E**	**OPTC6**		**C6**		X	X	X	X	X	X	X
DeviceNet	D, **E**	**OPTC7**		**C7**		X	X	X	X	X	X	X
Modbus (D9 Type Connector)	D, **E**	**OPTC8**		**C8**		X	X	X	X	X	X	X
Adapter — SPX Only	D, **E**	**OPTD1**		**D1**		X	X	X	X	X	X	X
Adapter — SPX Only	D, **E**	**OPTD2**		**D2**		X	X	X	X	X	X	X
RS-232 with D9 Connection	D, **E**	**OPTD3**		**D3**		X	X	X	X	X	X	X
Keypad												
9000X Series Local/ Remote Keypad (Replacement Keypad)	—	**KEYPAD-LOC/ REM**		**—**		—	—	—	—	—	—	—
9000X Series Remote Mount Keypad Unit (Keypad not included, includes 10 ft. cable, keypad holder, mounting hardware)	—	**OPTRMT-KIT-9000X**		**—**		—	—	—	—	—	—	—
9000X Series RS-232 Cable, 13 ft.	—	**PP00104**		**—**		—	—	—	—	—	—	—

① Option card must be installed in one of the slots listed for that card. Slot indicated in Bold is the preferred location.
② AI = Analog Input; AO = Analog Output, DI = Digital Input, DO = Digital Output, RO = Relay Output
③ OPTC2 is a multi-protocol option card.
④ SPX9000 Drives only (FR10 and larger).

Discount Symbol **SS-2**

Modbus RTU Network Communications

The Modbus Network Card OPTC2 is used for connecting the 9000X Drive as a slave on a Modbus network. The interface is connected by a 9-pin DSUB connector (female) and the baud rate ranges from 300 to 19200 baud. Other communication parameters include an address range from 1 to 247; a parity of None, Odd or Even; and the stop bit is 1.

Profibus Network Communications

The Profibus Network Card OPTC3 is used for connecting the 9000X Drive as a slave on a Profibus-DP network. The interface is connected by a 9-pin DSUB connector (female). The baud rates range from 9.6K baud to 12M baud, and the addresses range from 1 to 127.

LonWorks Network Communications

The LonWorks Network Card OPTC4 is used for connecting the 9000X Drive on a LonWorks network. This interface uses Standard Network Variable Types (SNVT) as data types. The channel connection is achieved using a FTT-10A Free Topology transceiver via a single twisted transfer cable. The communication speed with LonWorks is 78 kBits/s.

CanOpen (Slave) Communications

The CanOpen (Slave) Network Card OPTC6 is used for connecting the 9000X Drive to a host system. According to ISO11898 standard cables to be chosen for CAN bus should have a nominal impedance of 120Ω, and specific line delay of nominal 5 nS/m. 120Ω line termination resistors required for installation.

DeviceNet Network Communications

The DeviceNet Network Card OPTC7 is used for connecting the 9000X Drive on a DeviceNet Network. It includes a 5.08 mm pluggable connector. Transfer method is via CAN using a 2-wire twisted shielded cable with 2-wire bus power cable and drain. The baud rates used for communication include 125K baud, 250K baud and 500K baud.

Johnson Controls Metasys™ N2 Network Communications

The OPTC2 fieldbus board provides communication between the 9000X Drive and a Johnson Controls Metasys™ N2 network. With this connection, the drive can be controlled, monitored and programmed from the Metasys system. The N2 fieldbus is available as a factory installed option and as a field installable kit.

Modbus/TCP Network Communications

The Modbus/TCP Network Card OPTCI is used for connecting the 9000X Drive to Ethernet networks utilizing Modbus protocol. It includes an RJ-45 pluggable connector. This interface provides a selection of standard and custom register values to communicate drive parameters. The board supports 10 Mbps and 100 Mbps communication speeds. The IP address of the board is configurable over Ethernet using a supplied software tool.

BACnet Network Communications

The BACnet Network Card OPTCJ is used for connecting the 9000X Drive to BACnet networks. It includes a 5.08 mm pluggable connector. Data transfer is Master-Slave/Token Passing (MS/TP) RS-485. This interface uses a collection of 30 Binary Value Objects (BVOs) and 35 Analog Value Objects (AVOs) to communicate drive parameters. The card supports 9.6, 19.2 and 38.4 Kbaud communication speeds and supports network addresses 1 – 127.

Ethernet/IP Network Communications

The Ethernet/IP Network Card OPTCK is used for connecting the 9000X Drive to Ethernet/Industrial Protocol networks. It includes an RJ-45 pluggable connector. The interface uses CIP objects to communicate drive parameters (CIP is “Common Industrial Protocol”, the same protocol used by DeviceNet). The board supports 10 Mbps and 100 Mbps communication speeds. The IP address of the board is configurable by Static, BOOTP and DHCP methods.

Options

Control Panel Options

Table 40-86. Control Panel Factory Options

Description	Factory Installed		Field Installed	
			NEMA Type 1	
	Option Code	Adder U.S. $	Catalog Number	Price U.S. $
Local/Remote Keypad SVX9000 Control Panel — This option is standard on all drives and consists of an RS-232 connection, backlit alphanumeric LCD display with nine indicators for the RUN status and two indicators for the control source. The nine pushbuttons on the panel are used for panel programming and monitoring of all SVX9000 parameters. The panel is detachable and isolated from the input line potential. Include LOC/REM key to choose control location.	A		KEYPAD-LOC/REM	
Keypad Remote Mounting Kit — This option is used to remote mount the SVX9000 keypad. The footprint is compatible to the SV9000 remote mount kit. Includes 10 ft. cable, keypad holder and mounting hardware.	—		OPTRMT-KIT-9000X	

Table 40-87. Miscellaneous Options

Description	Catalog Number	Price U.S. $
9000XDrive — A PC-based tool for controlling and monitoring of the SVX9000. Features include: loading parameters that can be saved to a file or printed, setting references, starting and stopping the motor, monitoring signals in graphical or text form, and real-time display. To avoid damage to the drive or computer, SVDrivecable must be used.	9000XDRIVE	
SVDrivecable — 6 ft. (1.8m) RS-232 cable (22 gauge) with a 7-pin connector on each end. Should be used in conjunction with the 9000X Drive option to avoid damage to the SVX9000 or computer. The same cable can be used for downloading specialized applications to the drive.	SVDRIVECABLE	
External Dynamic Braking Resistors — Used with the Dynamic Braking Chopper Circuit to absorb motor regenerative energy for stopping the load and to dissipate the energy flowing back into the drive. Resistors are separated into Standard Duty and Heavy-Duty. Standard Duty is defined as 20% duty or less with 100% braking torque, while Heavy-Duty is defined as 50% duty or less with 150% braking torque. *Consult factory.*	①	

① Consult factory.

Brake Chopper Options

The Brake Chopper Circuit option is used for applications that require dynamic braking. Dynamic Braking resistors are not included with drive purchase. Consult the factory for dynamic braking resistors which are supplied separately. Resistors are not UL Listed.

Table 40-88. Brake Chopper Circuit Adder — NEMA Type 1, NEMA Type 12, Chassis

hp (I_H)	Adder U.S. $		
	208 – 240V	380 – 500V	525 – 690V
2 3 5vt 5ct 7-1/2vt 7-1/2ct			
10 15 20 25 30 40			
50 60 75 100 125 150			

hp (I_H)	Adder U.S. $		
	208 – 240V	380 – 500V	525 – 690V
200vt 200ct 250 300 350 400			
450 500 550 600vt 600ct 700vt 700ct			
800 900 1000 1200 1350 1500 1600 2000			

Note: Delivery code is FP.

Table 40-89. Conformal (Varnished) Coating Adder — 208 – 240V, 380 – 500V, 525 – 690V
(See Catalog Number Description to order.)

Frame	Delivery Code	Adder U.S. $
FR4 FR5 FR6	FP FP FP	
FR7 FR8 FR9	FP FP FP	
FR10 FR11 FR12	FP FP FP	
FR13 FR14	FP FP	

Table 40-90. Conformal Coated Board Kits ②

Field Installed		Factory Installed	
Catalog Number	Price U.S. $	Option Designator	Adder U.S. $
OPT_V ④		③	

② See Option Catalog Numbers on **Page 40-58**.
③ Construct Catalog Numbers for factory installed per **Table 40-72** on **Page 40-53**.
④ Replace "__" with the correct Catalog Number from **Page 40-58**. Example: OPT**C2**V.

Discount Symbol **SS-2**

Accessories

Demo Drive and Power Supply

Table 40-91. Demo Drive and Power Supply

Description	Catalog Number	Price U.S. $
9000X Drive Demo	**9000XDEMO**	
Hand Held 24V Auxiliary Power Supply — used to supply power to the control module in order to perform keypad programming before the drive is connected to line voltage	**9000XAUX24V**	

NEMA Type 12 Conversion Kit

The NEMA Type 12 kit option is used to convert a NEMA Type 1 to a NEMA Type 12 drive. The NEMA Type 12 Kit consists of a metal drive shroud, fan kit for some frames, adaptor plate and plugs.

Table 40-92. NEMA Type 12 Conversion Kit

Frame Size	Delivery Code	Approximate Dimensions in Inches (mm)			Approximate Weight in Lb. (kg)	Catalog Number	Price U.S. $
		Length	Width	Height	Weight		
FR4	W	13 (330)	7 (178)	4 (102)	4 (1.8)	**OPTN12FR4**	
FR5	W	16 (406)	8 (203)	7 (178)	5 (2.3)	**OPTN12FR5**	
FR6	W	21 (533)	10 (254)	5 (127)	7 (3.2)	**OPTN12FR6**	

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Flange Kits

Flange Kit Type 12

The flange kit is utilized when the power section is mounted through the back panel of an enclosure. Includes flange mount brackets and NEMA Type 12 fan components. Metal shroud not included.

Table 40-93. Flange Kit Type 12 — Frames 4, 5 and 6 ①

Frame Size	Delivery Code	Catalog Number	Price U.S. $
FR4	W	**OPTTHRFR4**	
FR5	W	**OPTTHRFR5**	
FR6	W	**OPTTHRFR6**	

① For installation of an SVX9000 NEMA Type 1 drive into a NEMA Type 12 oversized enclosure.

Flange Kit Type 1

Flange kits for NEMA 1 enclosure drive rating are determined by rating of drive.

Table 40-94. Flange Kit Type 1 — Frames 4 – 9 ②

Frame Size	Delivery Code	Catalog Number	Price U.S. $
FR4	FP	**OPTTHR4**	
FR5	FP	**OPTTHR5**	
FR6	FP	**OPTTHR6**	
FR7	FP	**OPTTHR7**	
FR8	FP	**OPTTHR8**	
FR9	FP	**OPTTHR9**	

② For installation of an SVX9000 NEMA Type 1 drive into a NEMA Type 1 oversized enclosure.

Flange Kit Type 12

Flange kits for NEMA 12 enclosure drive rating are determined by rating of drive.

Table 40-95. Flange Kit Type 12 — Frames 4 – 9 ③

Frame Size	Delivery Code	Catalog Number	Price U.S. $
FR4	FP	**OPTTHR4**	
FR5	FP	**OPTTHR5**	
FR6	FP	**OPTTHR6**	
FR7	FP	**OPTTHR7**	
FR8	FP	**OPTTHR8**	
FR9	FP	**OPTTHR9**	

③ For installation of an SVX9000 NEMA Type 12 drive into a NEMA Type 12 oversized enclosure.

Discount Symbol........................ **SS-2**

Dimensions

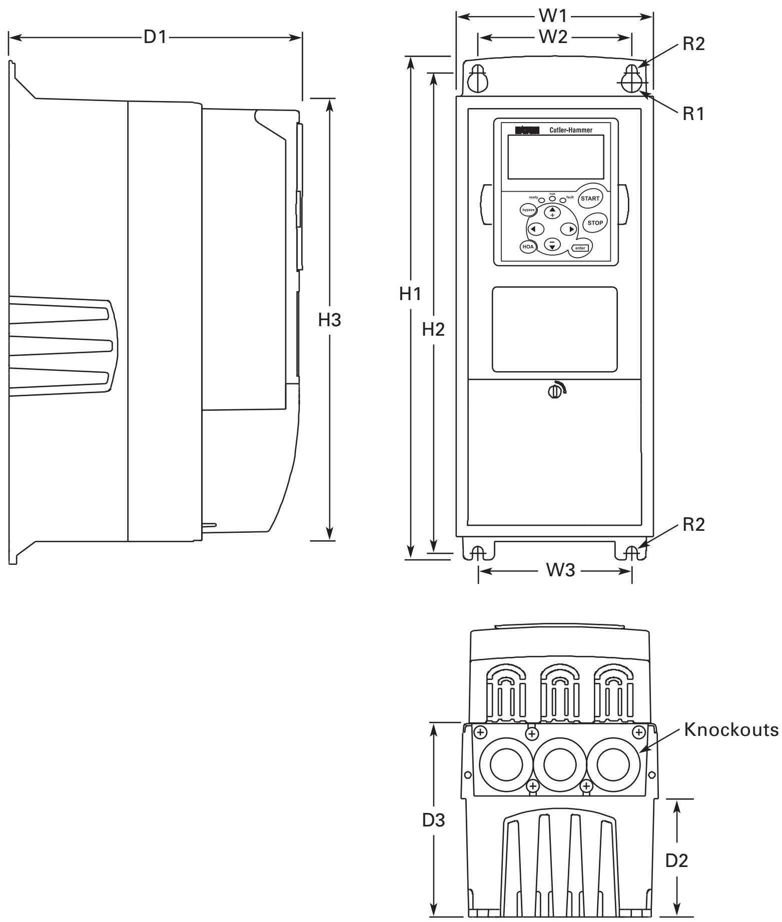


Figure 40-22. NEMA Type 1 and NEMA Type 12 9000X Drive Dimensions, FR4, FR5 and FR6

Table 40-96. 9000X Drive Dimensions

Frame Size	Voltage	hp (I_H)	Approximate Dimensions in Inches (mm)											Weight Lbs. (kg)	Knockouts @ Inches (mm)
			H1	H2	H3	D1	D2	D3	W1	W2	W3	R1 dia.	R2 dia.		N1 (O.D.)
FR4	230V	3/4 – 3	12.9 (327)	12.3 (313)	11.5 (292)	7.5 (190)	3.0 (77)	5.0 (126)	5.0 (128)	3.9 (100)	—	.5 (13)	.3 (7)	11.0 (5)	3 @ 1.1 (28)
	480V	1 – 5													
FR5	230V	5 – 7-1/2	16.5 (419)	16.0 (406)	15.3 (389)	8.4 (214)	3.9 (100)	5.8 (148)	5.6 (143)	3.9 (100)	—	.5 (13)	.3 (7)	17.9 (8)	2 @ 1.5 (37) 1 @ 1.1 (28)
	480V	7-1/2 – 15													
FR6	230V	10 – 15	22.0 (558)	21.3 (541)	20.4 (519)	9.3 (237)	4.2 (105)	6.5 (165)	7.6 (195)	5.8 (148)	—	.6 (15.5)	.4 (9)	40.8 (19)	3 @ 1.5 (37)
	480V	20 – 30													
	575V	2 – 25													

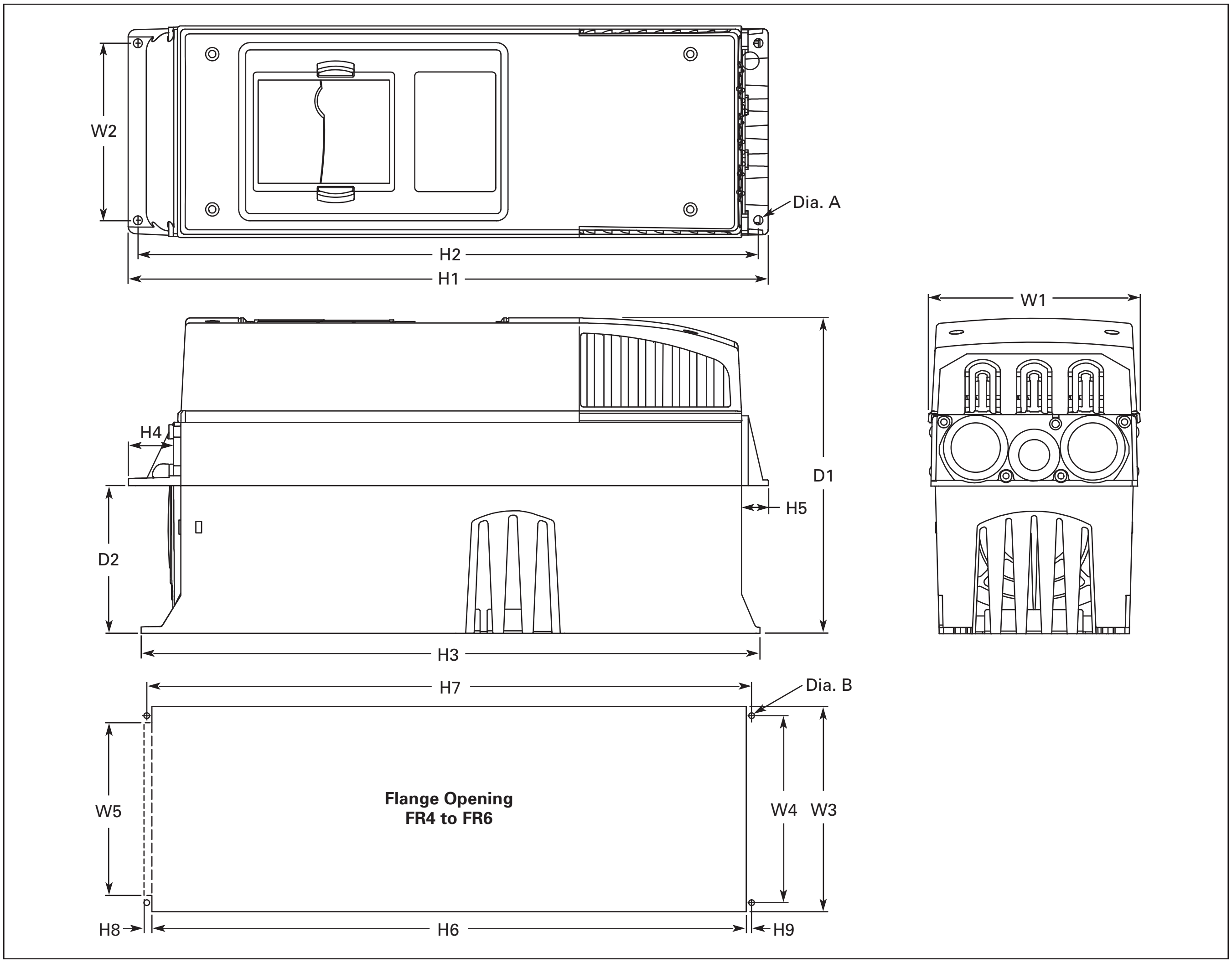


Figure 40-23. 9000X Dimensions, NEMA Type 1 and NEMA Type 12 with Flange Kit, FR4, FR5 and FR6

Table 40-97. Dimensions for 9000X, FR4, FR5 and FR6 with Flange Kit

Frame Size	Approximate Dimensions in Inches (mm)									
	W1	W2	H1	H2	H3	H4	H5	D1	D2	Dia. A
FR4	5.0 (128)	4.5 (113)	13.3 (337)	12.8 (325)	12.9 (327)	1.2 (30)	.9 (22)	7.5 (190)	3.0 (77)	.3 (7)
FR5	5.6 (143)	4.7 (120)	17.0 (434)	16.5 (420)	16.5 (419)	1.4 (36)	.7 (18)	8.4 (214)	3.9 (100)	.3 (7)
FR6	7.7 (195)	6.7 (170)	22.0 (560)	21.6 (549)	22.0 (558)	1.2 (30)	.8 (20)	9.3 (237)	4.2 (106)	.3 (7)

Table 40-98. Dimensions for the Flange Opening, FR4 to FR6

Frame Size	Approximate Dimensions in Inches (mm)							
	W3	W4	W5	H6	H7	H8	H9	Dia. B
FR4	4.8 (123)	4.5 (113)	—	12.4 (315)	12.8 (325)	—	.2 (5)	.3 (7)
FR5	5.3 (135)	4.7 (120)	—	16.2 (410)	16.5 (420)	—	.2 (5)	.3 (7)
FR6	7.3 (185)	6.7 (170)	6.2 (157)	21.2 (539)	21.6 (549)	.3 (7)	.2 (5)	.3 (7)

Open Drives

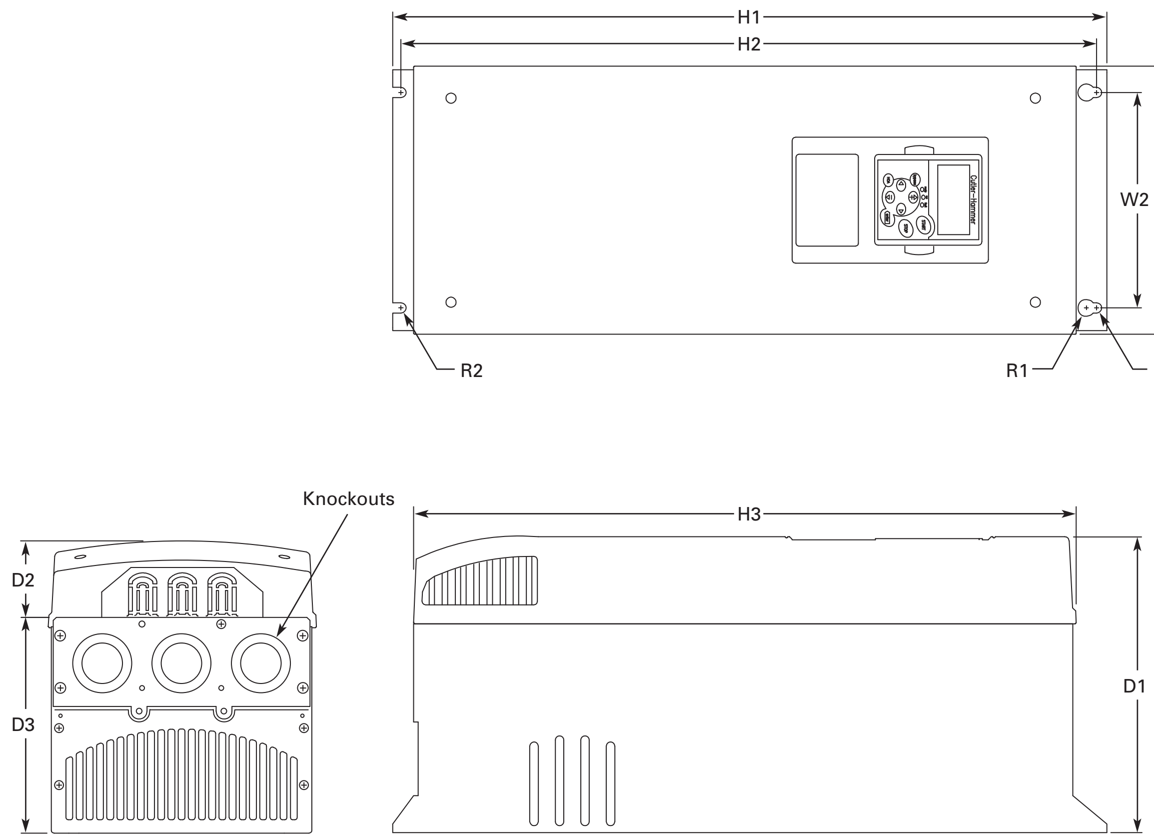


Figure 40-24. 9000X Dimensions, NEMA Type 1 and NEMA Type 12, FR7

Table 40-99. 9000X Drive Dimensions, FR7

Frame Size	Voltage	hp (I_H)	Approximate Dimensions in Inches (mm)										Weight lbs. (kg)	Knockouts @ Inches (mm)
			H1	H2	H3	D1	D2	D3	W1	W2	R1 dia.	R2 dia.		N1 (O.D.)
FR7	230V	20 – 30	24.8 (630)	24.2 (614)	23.2 (590)	10.1 (257)	3.0 (77)	7.3 (184)	9.3 (237)	7.5 (190)	.7 (18)	.4 (9)	77.2 (35)	3 @ 1.5 (37)
	480V	40 – 60												
	575V	30 – 40												

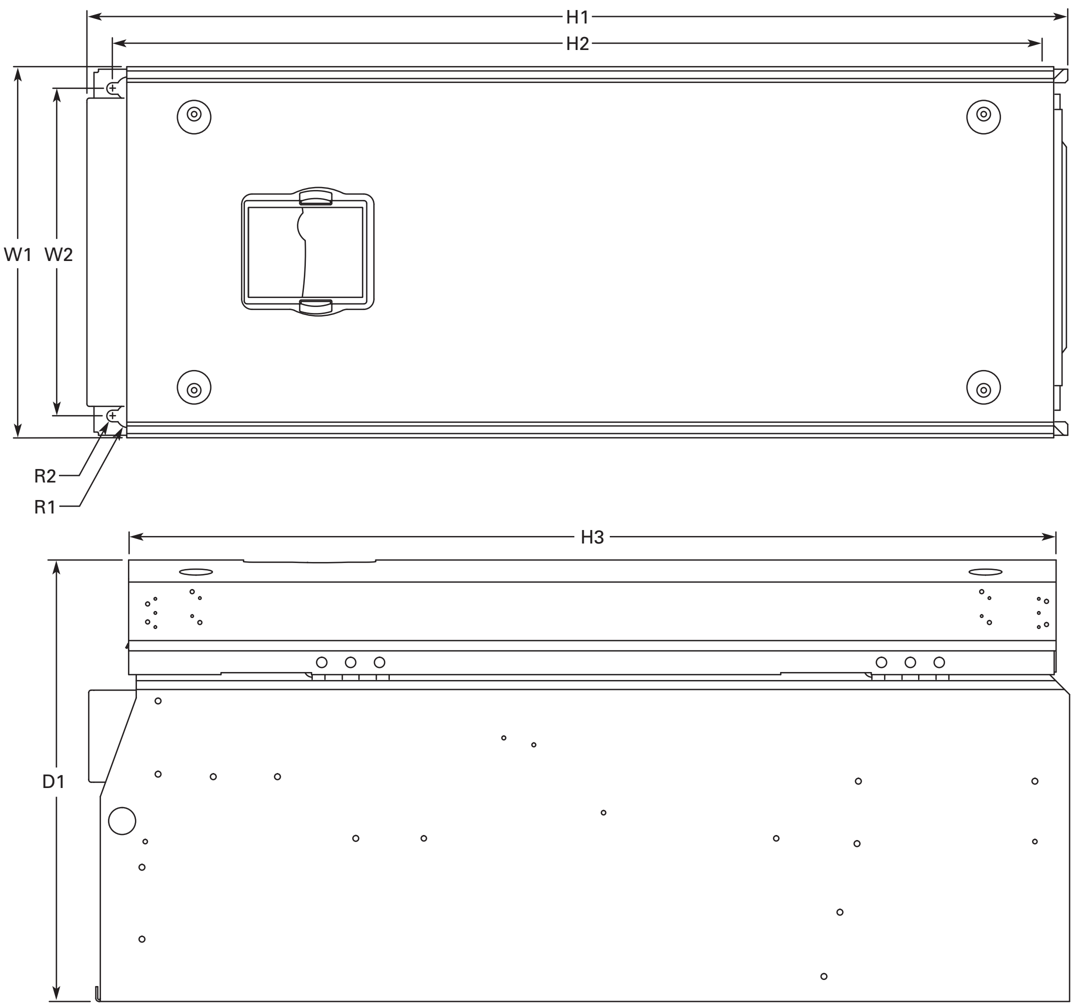


Figure 40-25. 9000X Dimensions, NEMA Type 1 and NEMA Type 12, FR8

Table 40-100. 9000X Drive Dimensions, FR8

Frame Size	Voltage	hp (I_H)	Approximate Dimensions in Inches (mm)								Weight lbs. (kg)
			D1	H1	H2	H3	W1	W2	R1 dia.	R2 dia.	
FR8	230V	40 – 60	13.5 (344)	30.1 (764)	28.8 (732)	28.4 (721)	11.5 (291)	10 (255)	.7 (18)	.4 (9)	127 (58)
	480V	75 – 125									
	575V	50 – 75									

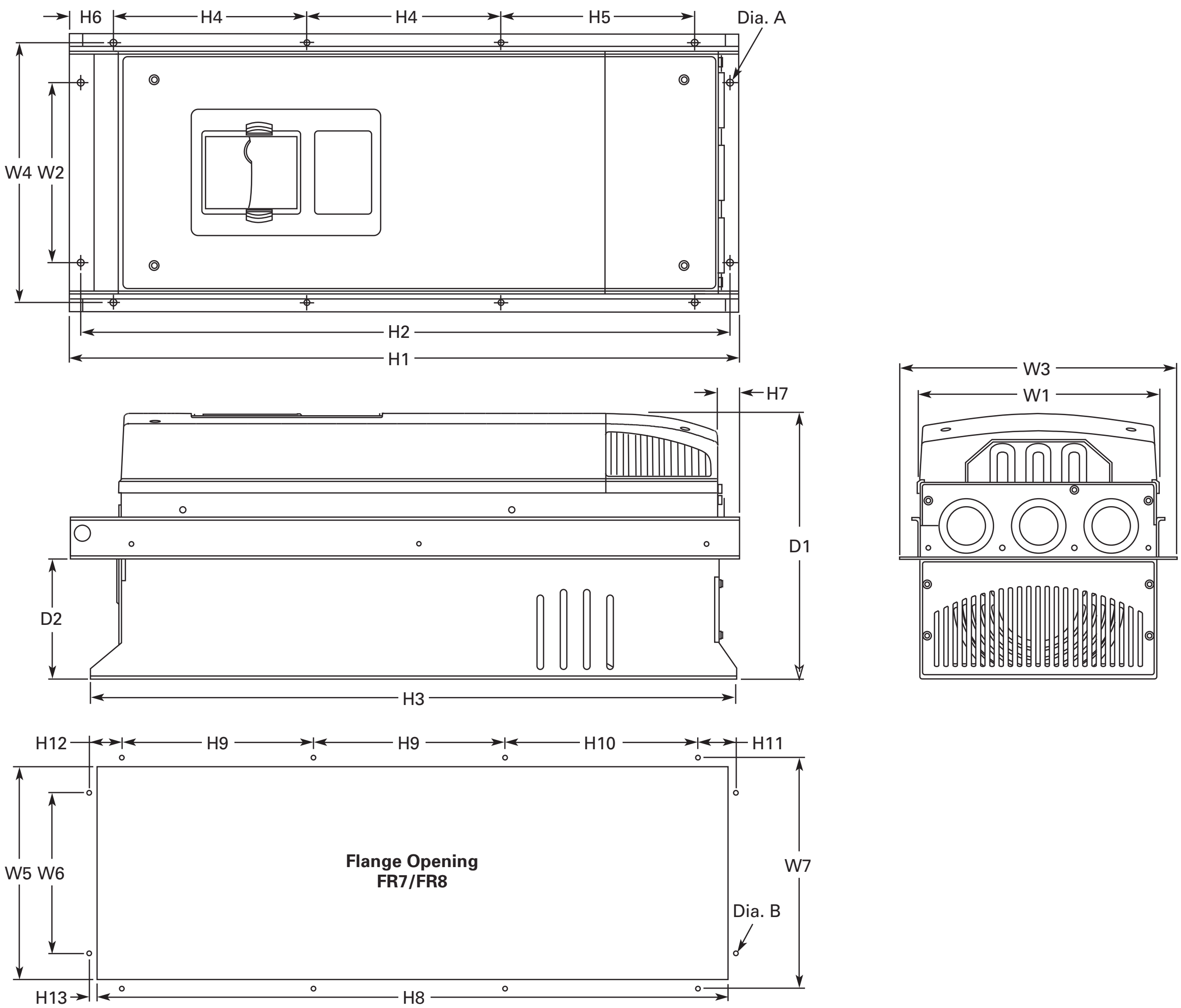


Figure 40-26. 9000X Dimensions, NEMA Type 1 and NEMA Type 12, with Flange Kit, FR7 and FR8

Table 40-101. Dimensions for 9000X, FR7 and FR8 with Flange Kit

Frame Size	Approximate Dimensions in Inches (mm)													
	W1	W2	W3	W4	H1	H2	H3	H4	H5	H6	H7	D1	D2	Dia. A
FR7	9.3 (237)	6.8 (175)	10.6 (270)	10.0 (253)	25.6 (652)	24.8 (632)	24.8 (630)	7.4 (189)	7.4 (189)	.9 (23)	.8 (20)	10.1 (257)	4.6 (117)	.3 (6)
FR8	11.2 (285)	—	14.0 (355)	13.0 (330)	32.8 (832)	—	29.3 (745)	10.2 (258)	10.4 (265)	1.7 (43)	2.2 (57)	13.5 (344)	4.3 (110)	.4 (9)

Table 40-102. Dimensions for the Flange Opening, FR7/FR8

Frame Size	Approximate Dimensions in Inches (mm)									
	W5	W6	W7	H8	H9	H10	H11	H12	H13	Dia. B
FR7	9.2 (233)	6.9 (175)	10.0 (253)	24.4 (619)	7.4 (189)	7.4 (189)	1.4 (35)	1.3 (32)	1.0 (25)	.3 (6)
FR8	11.9 (301)	—	13.0 (330)	31.9 (810)	10.2 (258)	10.4 (265)	—	—	1.3 (33)	.4 (9)

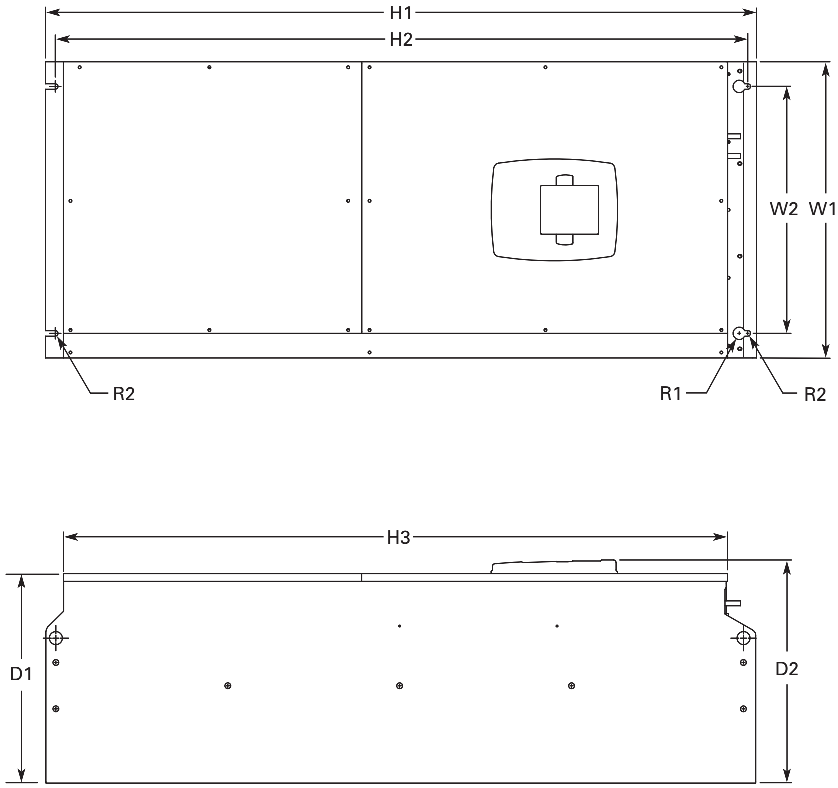


Figure 40-27. 9000X Dimensions, NEMA Type 1 and NEMA Type 12, FR9

Table 40-103. 9000X Drive Dimensions, FR9

Frame Size	Voltage	hp (I_H)	Approximate Dimensions in Inches (mm)									Weight lbs. (kg)
			H1	H2	H3	D1	D2	W1	W2	R1 dia.	R2 dia.	
FR9	230V	75 – 100	45.3 (1150)	44.1 (1120)	42.4 (1076)	13.4 (340)	14.3 (362)	18.9 (480)	15.7 (400)	.8 (20)	.4 (9)	321.9 (146)
	480V	150 – 200										
	575V	100 – 175										

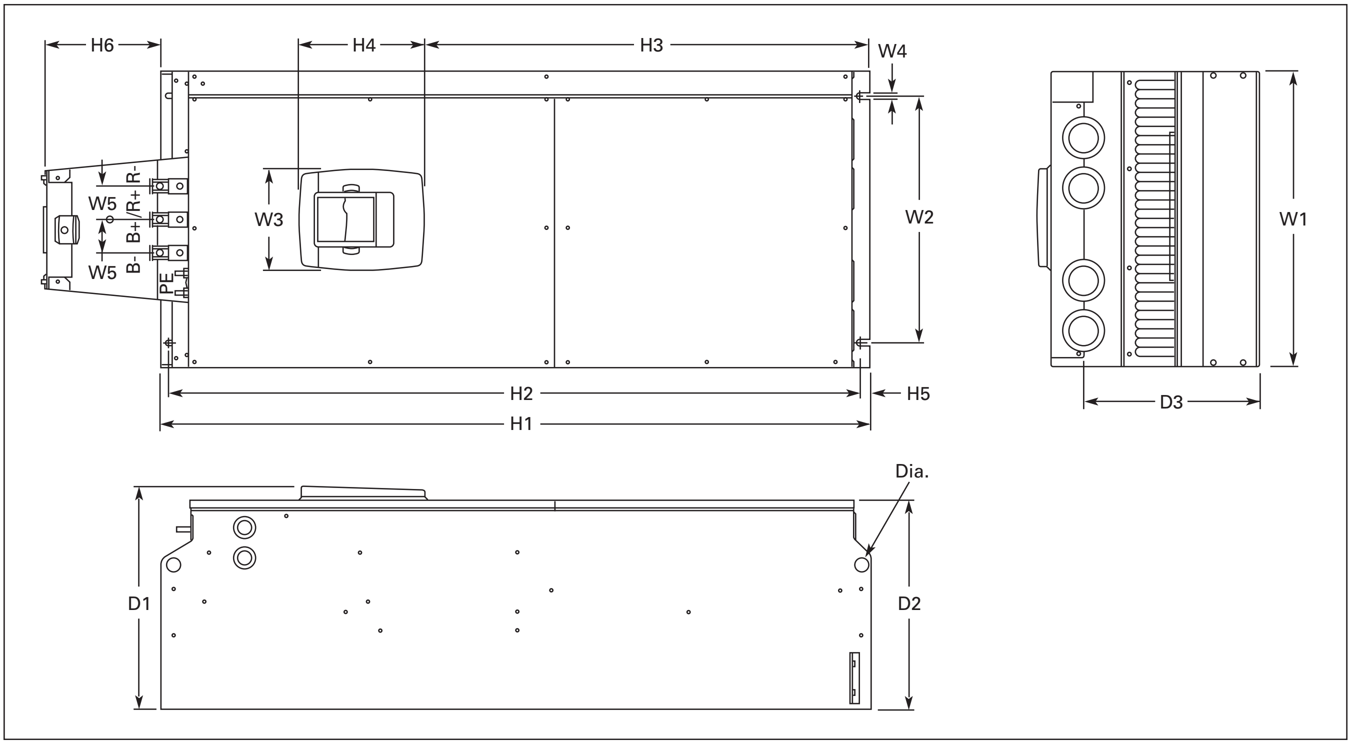


Figure 40-28. 9000X Dimensions, NEMA Type 1 and NEMA Type 12 FR9

Table 40-104. Dimensions for 9000X, FR9

Frame Size	Approximate Dimensions in Inches (mm)													
	W1	W2	W3	W4	W5	H1	H2	H3	H4	H5	H6 ①	D1	D2	D3	Dia.
FR9	18.9 (480)	15.7 (400)	6.5 (165)	.4 (9)	2.1 (54)	45.3 (1150)	44.1 (1120)	28.3 (721)	8.0 (205)	.6 (16)	7.4 (188)	14.2 (361.5)	13.4 (340)	11.2 (285)	.8 (21)

① Brake resistor terminal box (H6) included when brake chopper ordered.

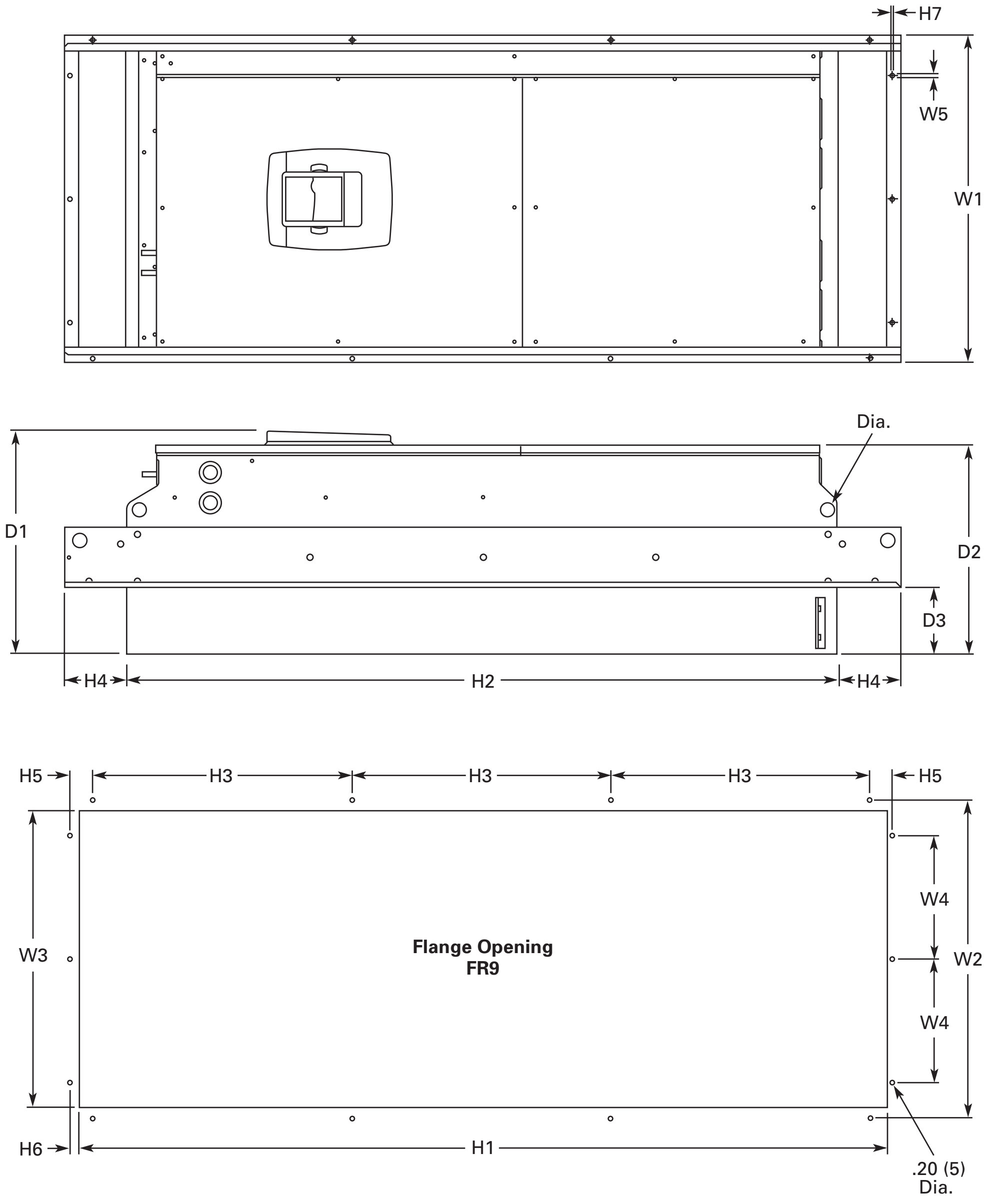


Figure 40-29. 9000X Dimensions, NEMA Type 1 and NEMA Type 12 FR9 with Flange Kit

Table 40-105. Dimensions for 9000X, FR9 with Flange Kit

Frame Size	Approximate Dimensions in Inches (mm)														
	W1	W2	W3	W4	W5	H1	H2	H3	H4	H5	H6	H7	D1	D2	D3	Dia.
FR9	20.9 (530)	20.0 (510)	19.1 (485)	7.9 (200)	.2 (5.5)	51.7 (1312)	45.3 (1150)	16.5 (420)	3.9 (100)	1.4 (35)	.4 (9)	.1 (2)	24.9 (362)	13.4 (340)	4.3 (109)	.8 (21)

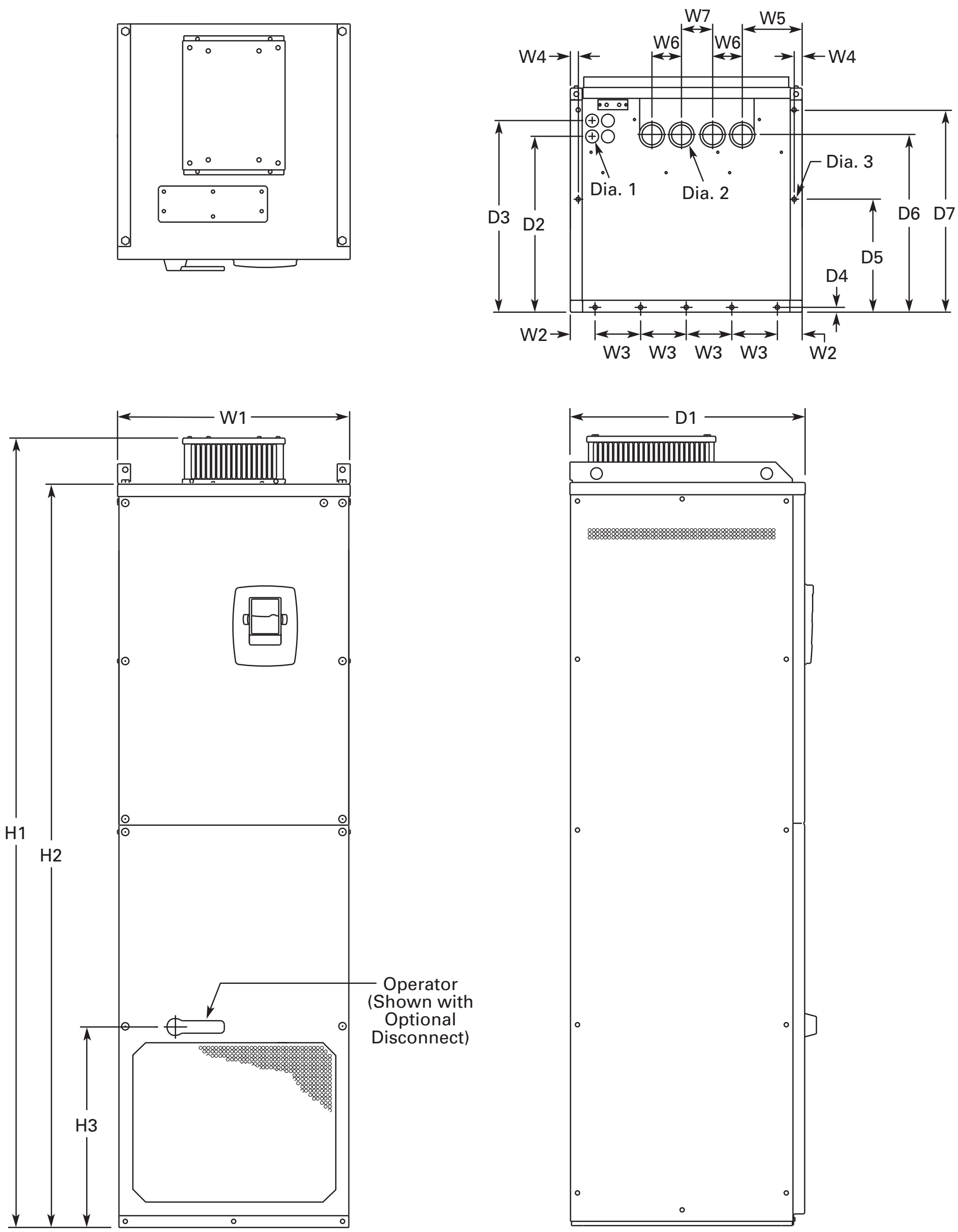


Figure 40-30. 9000X Dimensions, NEMA Type 1 and NEMA Type 12 FR10 Freestanding Drive

Table 40-106. Dimensions for 9000X, FR10 Freestanding Drive

Frame Size	Approximate Dimensions in Inches (mm)																			Weight lbs. (kg)
	W1	W2	W3	W4	W5	W6	W7	H1	H2	H3	D1	D2	D3	D4	D5	D6	D7	Dia. 1	Dia. 2	Dia. 3	
FR10	23.43 (595)	2.46 (62.5)	4.53 (115)	.79 (20)	5.95 (151)	2.95 (75)	3.11 (79)	79.45 (2018)	74.80 (1900)	20.18 (512.5)	23.70 (602)	17.44 (443)	19.02 (483)	.47 (12)	11.22 (285)	17.60 (447)	20.08 (510)	.83 (21)	1.89 (48)	.43 (11)	857 (389)

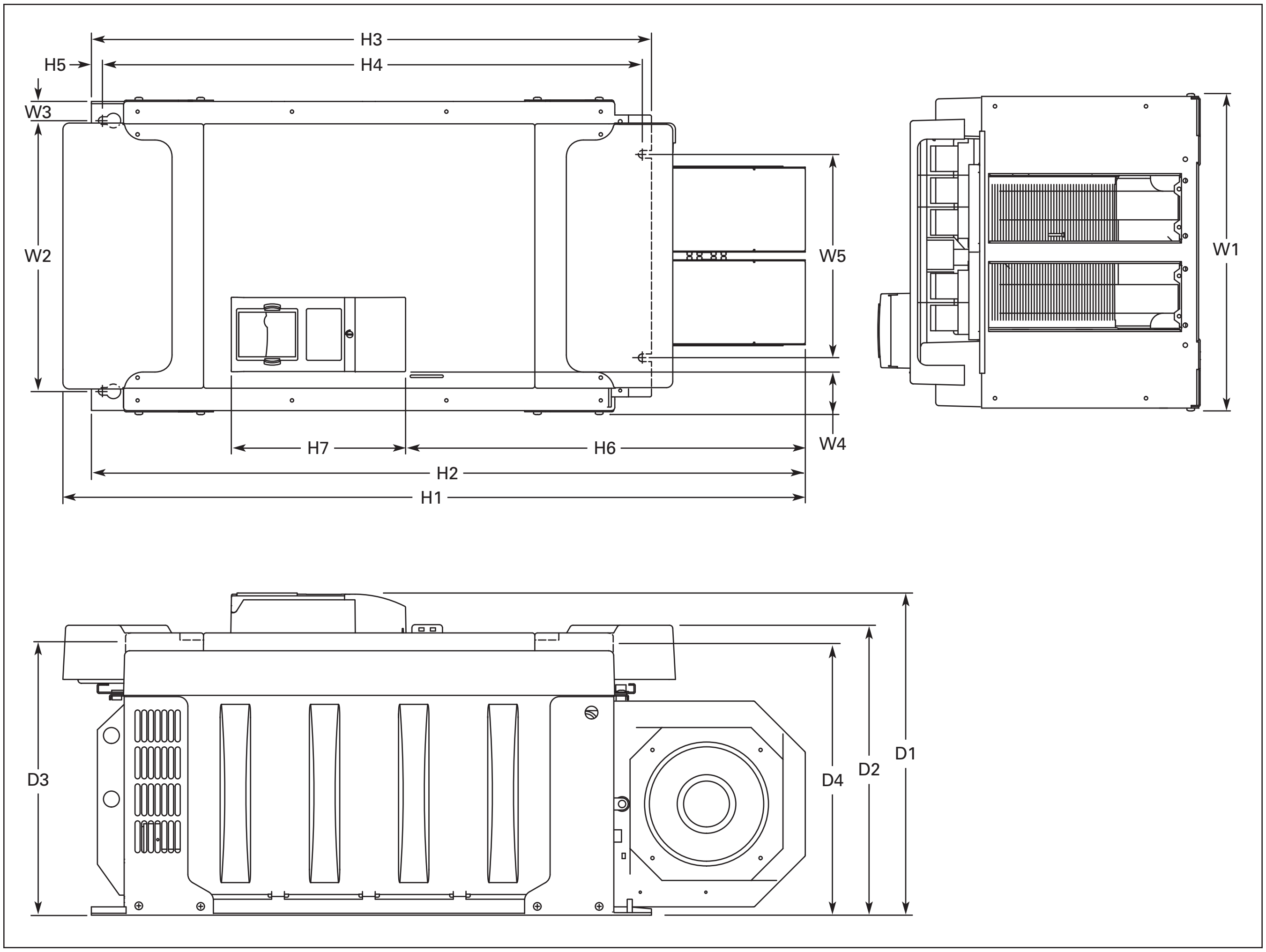


Figure 40-31. 9000X Dimensions, FR10 Open Chassis

Table 40-107. Dimensions for 9000X, FR10 Open Chassis

Frame Size	Voltage	hp (I_H)	Approximate Dimensions in Inches (mm)																Weight lbs. (kg)
			W1	W2	W3	W4	W5	H1	H2	H3	H4	H5	H6	H7	D1	D2	D3	D4	
FR10	480V	250 – 350	19.7 (500)	16.7 (425)	1.2 (30)	2.6 (67)	12.8 (325)	45.9 (1165)	44.1 (1121)	34.6 (879)	33.5 (850)	.7 (17)	24.7 (627)	10.8 (275)	19.9 (506)	17.9 (455)	16.7 (423)	16.6 (421)	518 (235)
	575V	200 – 300																	

Note: 9000X FR12 is built of two FR10 modules. Please refer to SPX9000 installation manual for mounting instructions.

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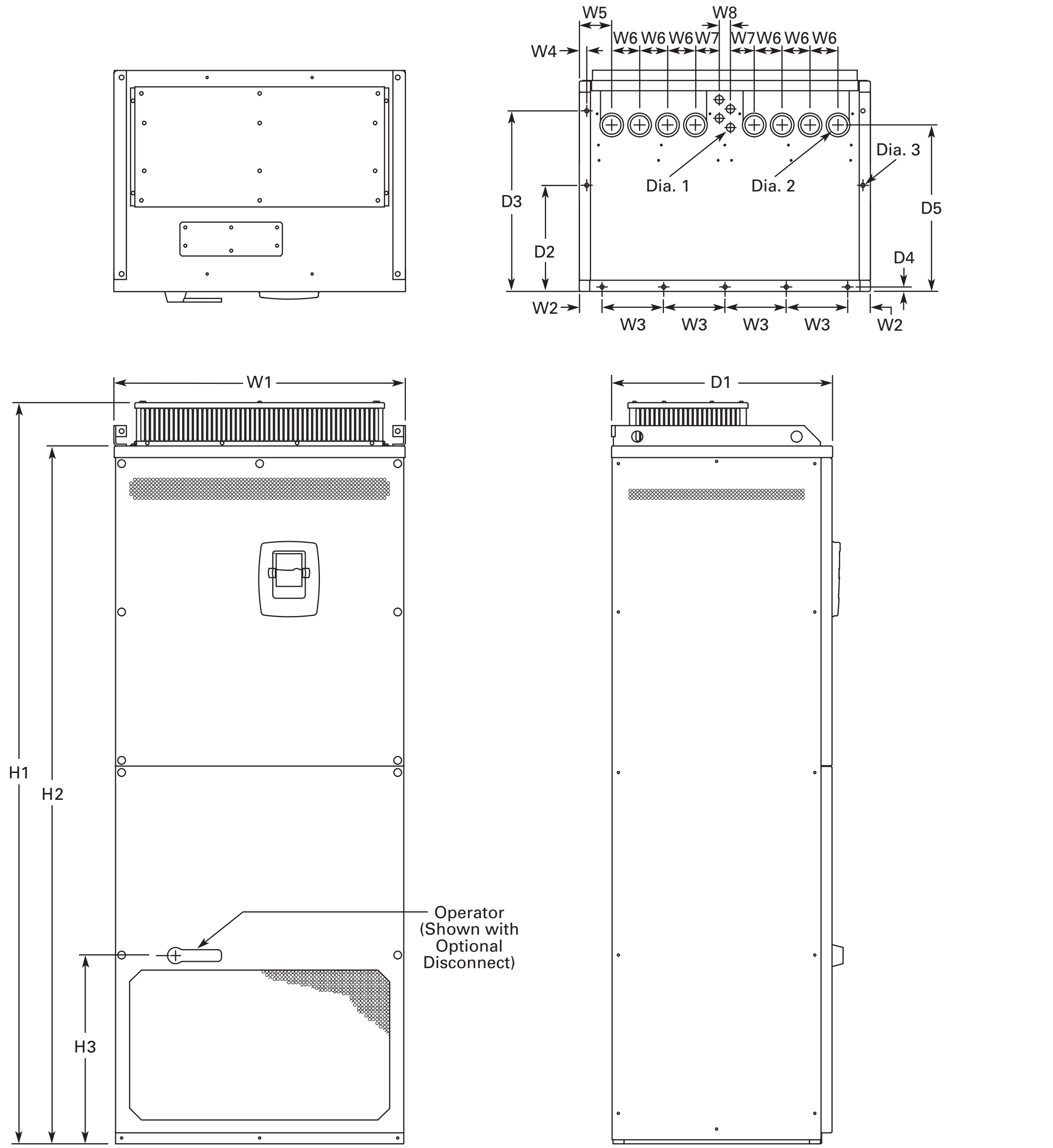


Figure 40-32. 9000X Dimensions, NEMA Type 1 FR11 Freestanding Drive

Table 40-108. Dimensions for 9000X, NEMA Type 1 FR11 Freestanding Drive

Frame Size	Voltage	hp (I_H)	Approximate Dimensions in Inches (mm)																		Weight lbs. (kg)
			W1	W2	W3	W4	W5	W6	W7	W8	H1	H2	H3	D1	D2	D3	D4	D5	Dia. 1	Dia. 2	Dia. 3	
FR11	480	400 – 550	31.26 (794)	2.40 (61)	6.50 (165)	.79 (20)	3.43 (87)	2.95 (75)	2.52 (64)	1.18 (30)	79.45 (2018)	74.80 (1900)	20.18 (512.5)	23.70 (602)	11.22 (285)	19.09 (485)	.47 (12)	17.60 (447)	.83 (21)	1.89 (48)	.35 x .43 (9 x 11)	526 (239)

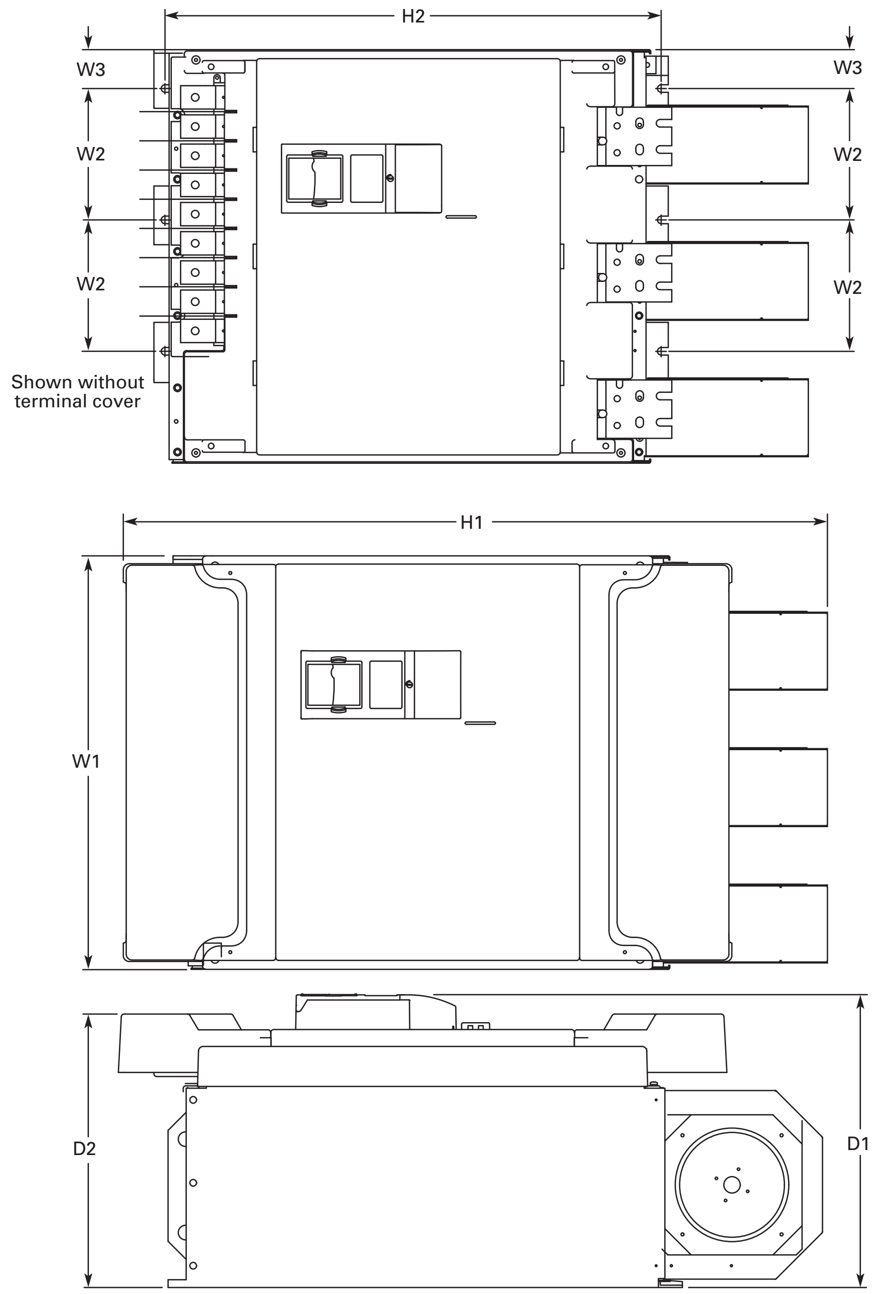


Figure 40-33. 9000X Dimensions, FR11 Open Chassis

Table 40-109. Dimensions for 9000X, FR11 Open Chassis

Frame Size	Voltage	hp (I_H)	Approximate Dimensions in Inches (mm)							Weight lbs. (kg)
			W1	W2	W3	H1	H2	D1	D2	
FR11	480V	400 – 550	27.9 (709)	8.86 (225)	2.6 (67)	45.5 (1155)	33.5 (850)	19.8 (503)	18.4 (468)	833 (378)
	575V	400 – 500								

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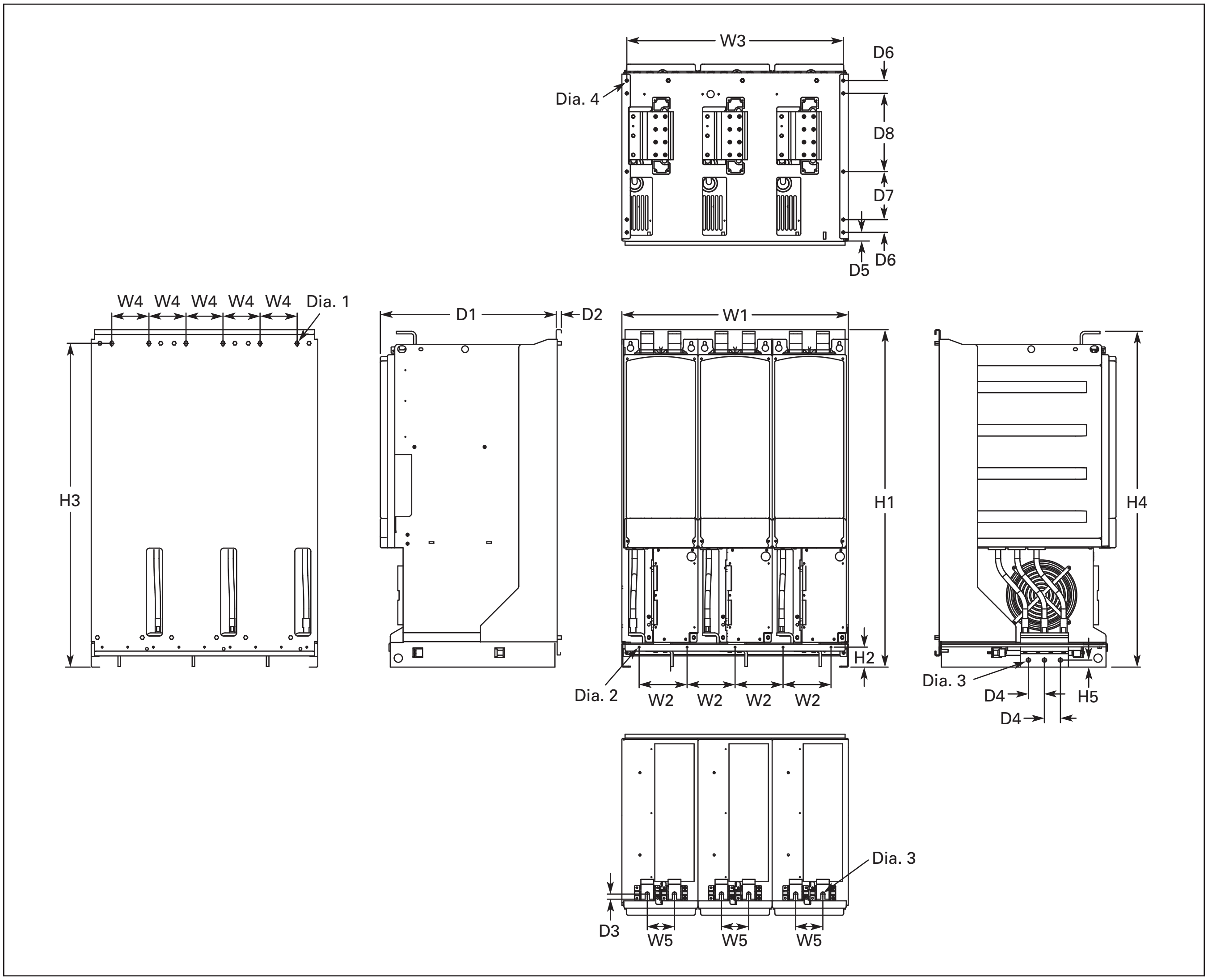


Figure 40-34. 9000X Dimensions, FR13 Open Chassis Inverter

Table 40-110. Dimensions for 9000X, FR13 Open Chassis Inverter

Frame Size	Approximate Dimensions in Inches (mm)																					Weight lbs. (kg)
	W1	W2	W3	W4	W5	H1	H2	H3	H4	H5	D1	D2	D3	D4	D5	D6	D7	D8	Dia. 1	Dia. 2	Dia. 3	Dia. 4	
FR13	27.87 (708)	5.91 (150)	26.65 (677)	4.57 (116)	3.35 (85)	41.54 (1055)	2.46 (62.5)	39.86 (1012.5)	41.34 (1050)	.79 (20)	21.77 (553)	.51 (13)	.63 (16)	1.97 (50)	1.06 (27)	1.57 (40)	5.91 (150)	9.64 (244.8)	.35x.59 (9x15)	.18 (4.6)	.51 (13)	.37 (9.5)	683 (310)

Note: 9000X FR14 is built of two FR13 modules. Please refer to SPX9000 installation manual for mounting instructions.

Note: FR13 is built from an inverter module and a converter module. Please refer to SPX9000 installation manual for mounting instructions.

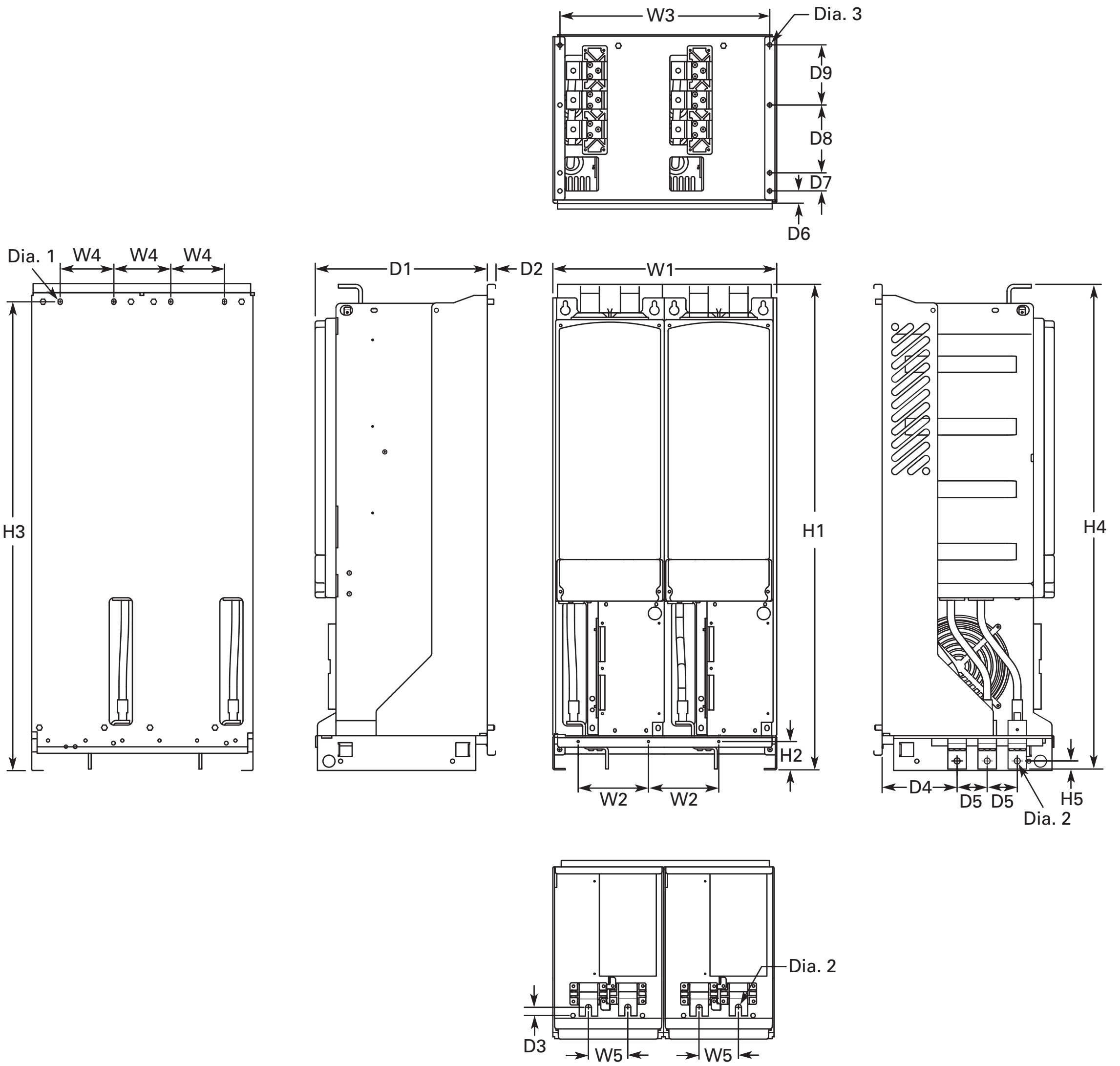


Figure 40-35. 9000X Dimensions, FR13 Open Chassis Converter

Table 40-111. FR13 — Number of Input Units

480V	hp	Input Modules	690V	hp	Input Modules
SPX800A0-4A2N1	800	2	**SPX800A0-5A2N1** **SPX900A0-5A2N1** **SPXH10A0-5A2N1**	800 900 1000	2 2 2

Table 40-112. Dimensions for 9000X, FR13 Open Chassis Converter

Frame Size	Approximate Dimensions in Inches (mm)																					Weight lbs. (kg)
	W1	W2	W3	W4	W5	H1	H2	H3	H4	H5	D1	D2	D3	D4	D5	D6	D7	D8	D9	Dia. 1	Dia. 2	Dia. 3	
FR13	18.74 (476)	5.91 (150)	17.52 (445)	4.57 (116)	3.35 (85)	41.54 (1055)	2.46 (62.5)	39.86 (1012.5)	41.34 (1050)	.69 (17.5)	14.69 (373)	.51 (13)	.73 (18.5)	6.42 (163)	2.56 (65)	1.06 (27)	1.57 (40)	5.91 (150)	5.24 (133)	.35x.59 (9x15)	.51 (13)	.37 (9.5)	295 (134)

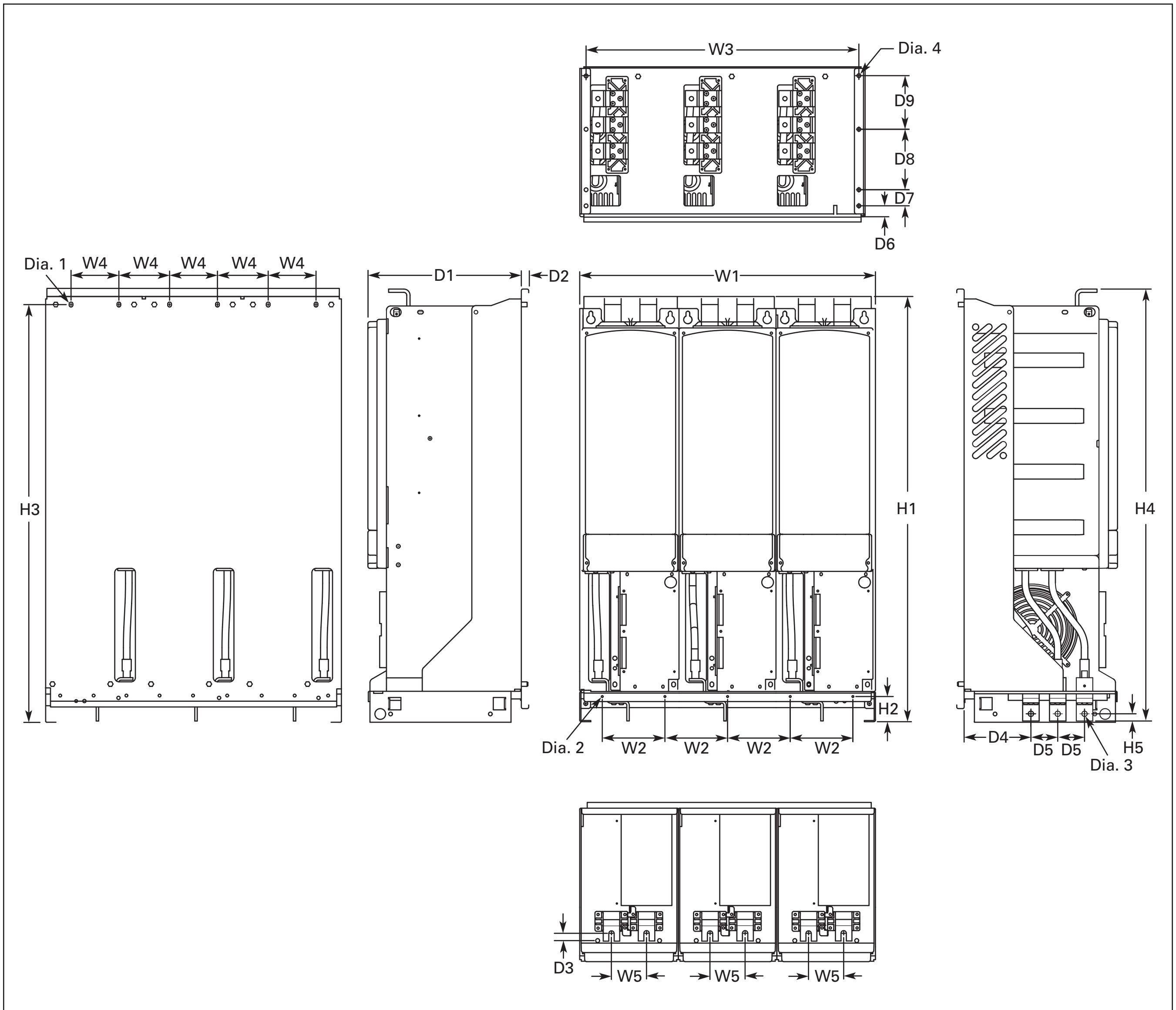


Figure 40-36. 9000X Dimensions, FR13 Open Chassis Converter — 900/1000 hp 480V

Table 40-113. FR13 — Number of Input Units

480V	hp	Input Modules
SPX900A0-4A2N1	900	3
SPXH10A0-4A2N1	1000	3

Table 40-114. Dimensions for 9000X, FR13 Open Chassis Converter — 900/1000 hp 480V

Frame Size	Approximate Dimensions in Inches (mm)																							Weight lbs. (kg)
	W1	W2	W3	W4	W5	H1	H2	H3	H4	H5	D1	D2	D3	D4	D5	D6	D7	D8	D9	Dia. 1	Dia. 2	Dia. 3	Dia. 4	
FR13	27.87 (708)	5.91 (150)	26.65 (677)	4.57 (116)	3.35 (85)	41.54 (1055)	2.46 (62.5)	39.86 (1012.5)	41.34 (1050)	.69 (17.5)	14.69 (373)	.51 (13)	.73 (18.5)	6.42 (163)	2.56 (65)	1.06 (27)	1.57 (40)	5.91 (150)	5.24 (133)	.35x.59 (9x15)	.18 (4.6)	.51 (13)	.37 (9.5)	443 (201)

Table 40-115. Choke Types

Catalog Number	Frame Size	Choke Type ①
Voltage Range 380 – 500V		
SPX 250 4	FR10	CHK0400
SPX 300 4	FR10	CHK0520
SPX 350 4	FR10	CHK0520
SPX 400 4	FR11	2 x CHK0400
SPX 500 4	FR11	2 x CHK0400
SPX 550 4	FR11	2 x CHK0400
SPX 600 4	FR12	2 x CHK0520
SPX 650 4	FR12	2 x CHK0520
SPX 700 4	FR12	2 x CHK0520
SPX 800 4	FR13	2 x CHK0400
SPX 900 4	FR13	3 x CHK0520
SPX H10 4	FR13	3 x CHK0520
SPX H12 4	FR14	4 x CHK0520
SPX H16 4	FR14	6 x CHK0400
Voltage Range 525 – 690V		
SPX 200 5	FR10	CHK0261
SPX 250 5	FR10	CHK0400
SPX 300 5	FR10	CHK0400
SPX 400 5	FR11	CHK0520
SPX 450 5	FR11	CHK0520
SPX 500 5	FR11	2 x CHK0400
SPX 550 5	FR12	2 x CHK0400
SPX 600 5	FR12	2 x CHK0400
SPX 700 5	FR12	2 x CHK0400
SPX 800 5	FR13	2 x CHK0400
SPX 900 5	FR13	2 x CHK0400
SPX H10 5	FR13	2 x CHK0400
SPX H13 5	FR14	4 x CHK0400
SPX H15 5	FR14	6 x CHK0400

① Chokes are provided with all FR10 – FR14 drives.

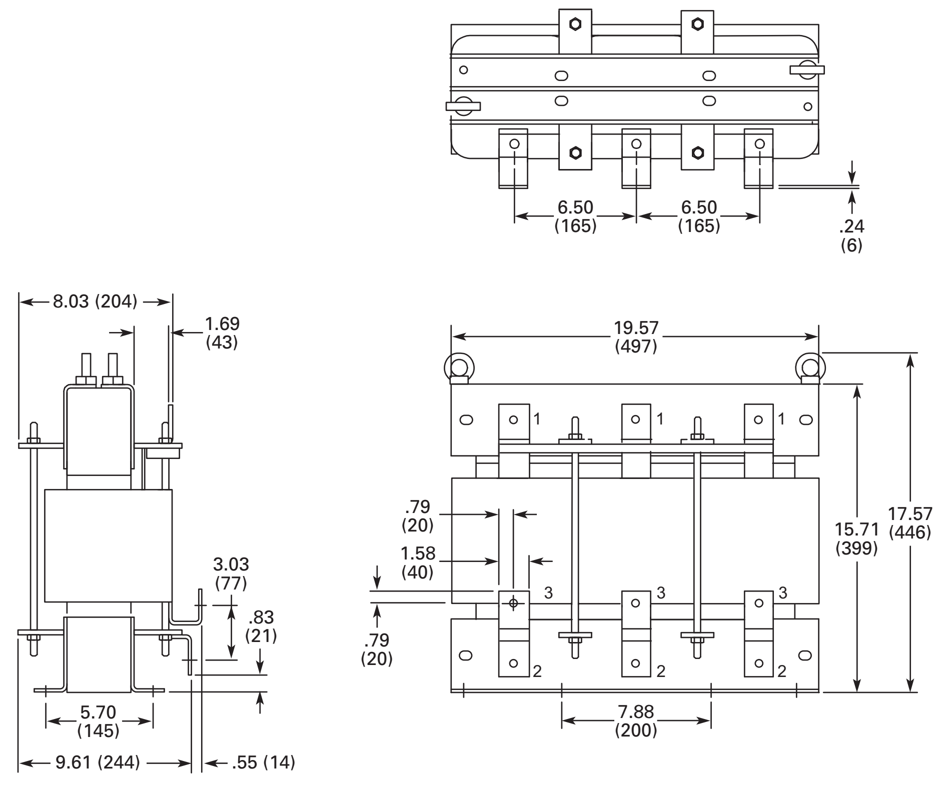


Figure 40-37. Dimensions of AC Choke CHK0520 in Inches (mm)

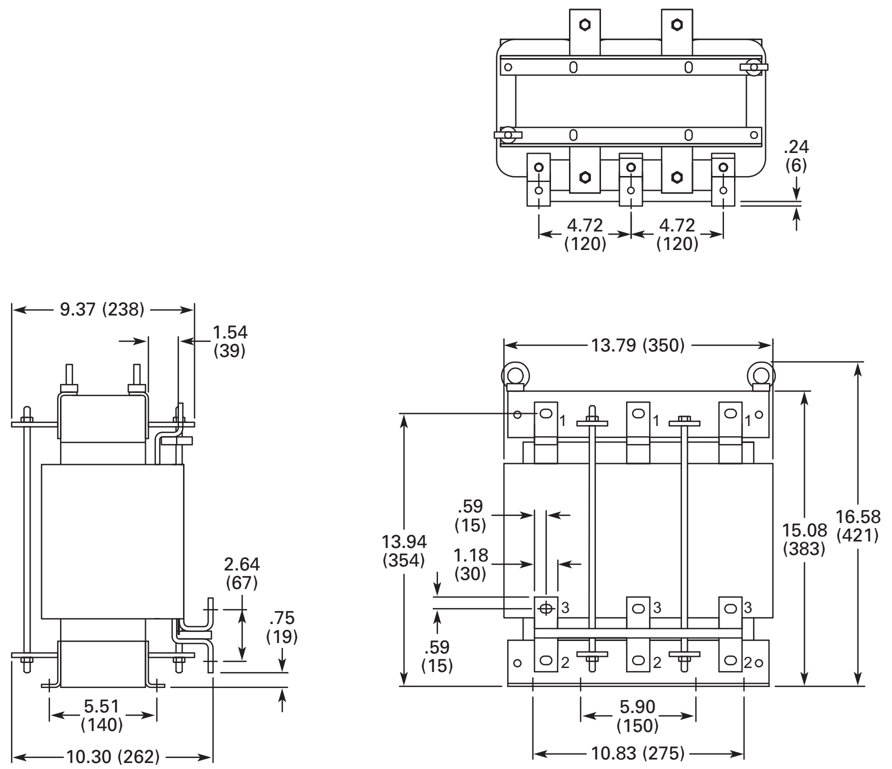


Figure 40-38. Dimensions of AC Choke CHK0400 in Inches (mm)

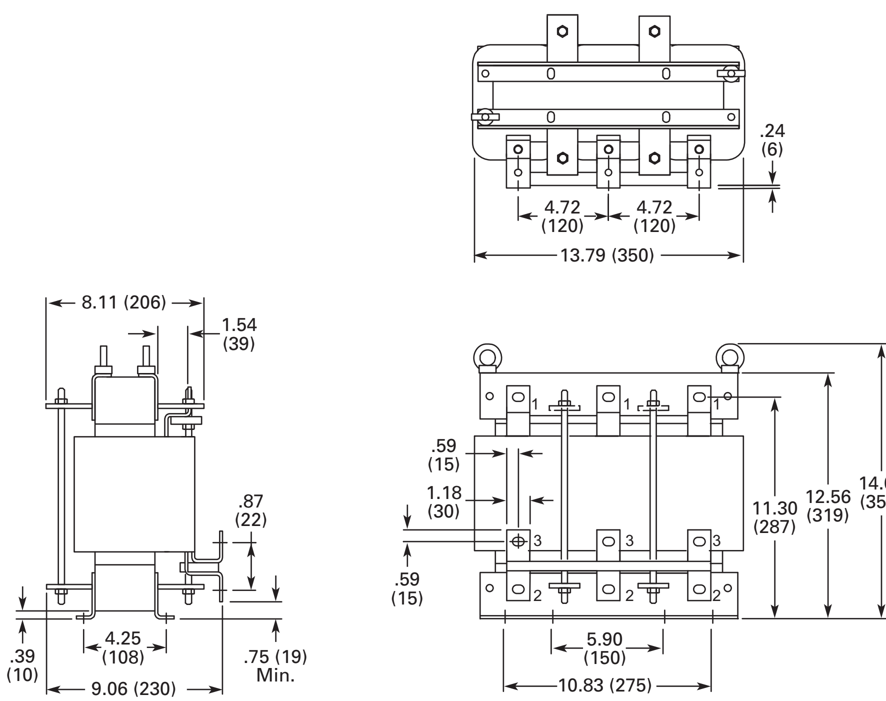


Figure 40-39. Dimensions of AC Choke CHK0261 in Inches (mm)

Spare Units & Replacement Parts

Table 40-116. 9000X Spare Units – SVX9000, 208 – 690V, Frames 4 – 12

Description	Catalog Number	Price U.S. $
Control Unit – Includes the control board, blue base housing, installed SVX9000 software program and blue flip cover. Does not include any OPT boards or keypad. See **Figure 40-21** and **Table 40-85** (**Page 40-58**) for standard and option boards and keypad.	**CSBS0000000000**	

Table 40-117. 9000X Series Replacement Parts — SVX9000 Drives, 208 – 240V

Frame:	4					5			6		7			8			Delivery Code	Catalog Number	Price U.S. $
hp (I_H):	3/4	1	1-1/2	2	3	5 ①	5	7-1/2	10	15	20	25	30	40	50	60			
Control Board																			
	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	W	**VB00252**	
Power Boards																			
	1																FB	**VB00308-0004-2**	
		1															FB	**VB00308-0007-2**	
			1														FB	**VB00308-0008-2**	
				1													FB	**VB00310-0011-2**	
					1												FB	**VB00310-0012-2**	
						1											FB	**VB00313-0017-2**	
							1										FB	**VB00313-0025-2**	
								1									FB	**VB00313-0031-2**	
									1								FB	**VB00316-0048-2**	
										1							FB	**VB00316-0061-2**	
											1						FB	**VB00319-0075-2**	
												1					FB	**VB00319-0088-2**	
													1				FB	**VB00319-0114-2**	
														1			FB	**VB00322-0140-2**	
															1		FB	**VB00322-0170-2**	
																1	FB	**VB00322-0205-2**	
Electrolytic Capacitors																			
	2	2	2														W	**PP01000**	
				2	2												W	**PP01001**	
						2	2										W	**PP01002**	
								2									W	**PP01003**	
									2	2							W	**PP01004**	
											2	2	2	4	4		W	**PP01005**	
																4	W	**PP01099**	
Cooling Fans																			
	1	1	1	1	1												W	**PP01060**	
						1	1	1									W	**PP01061**	
									1	1							W	**PP01062**	
											1	1	1				W	**PP01063**	
														1	1	1	FC	**PP01123** ②	
	1	1	1	1	1												W	**PP01086**	
						1	1	1	1	1							FC	**PP01088**	
											1	1	1				W	**PP01049**	
														1	2	2	FC	**CP01180**	
														1	1	1	FC	**PP08037**	

① I_L only; has no corresponding I_H rated hp rating.
② PP00061 capacitor not included in main fan; please order separately.

Discount Symbol **SS-2**

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Open Drives

Table 40-117. 9000X Series Replacement Parts — SVX9000 Drives, 208 – 240V (Continued)

Frame:	4					5			6		7			8			Delivery Code	Catalog Number	Price U.S. $
hp (I_H):	3/4	1	1-1/2	2	3	5 ①	5	7-1/2	10	15	20	25	30	40	50	60			
IGBT Modules																			
	1	1															W	**CP01304**	
			1														W	**CP01305**	
				1	1	1											W	**CP01306**	
							1										W	**CP01307**	
								1									W	**CP01308**	
									1								W	**PP01022**	
										1							W	**PP01023**	
											1						W	**PP01024**	
												1					W	**PP01025**	
													1				W	**PP01029**	
														1			W	**PP01026**	
															1	1	W	**PP01027**	
Choppers/Rectifiers																			
									1								W	**CP01367**	
										1							W	**CP01368**	
Diode/Thyristor Modules																			
											3	3	3				W	**PP01035**	
														3	3	3	W	**CP01268**	
Rectifying Boards																			
											1	1	1				W	**VB00242**	
														1	1	1	W	**VB00227**	

① I_L only; has no corresponding I_H rated hp rating.

Table 40-118. 9000X Series Replacement Parts — FR4 – FR9 SVX9000 Drives, 380 – 500V

Frame:	4						5			6			7			8			9		Delivery Code	Catalog Number	Price U.S. $
hp (I_H):	1	1-1/2	2	3	5	7-1/2 ②	7-1/2	10	15	20	25	30	40	50	60	75	100	125	150	200			
Control Board																							
	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	W	**VB00252**	
Power Boards																							
	1																				FB	**VB00208-0003-5**	
		1																			FB	**VB00208-0004-5**	
			1																		FB	**VB00208-0005-5**	
				1																	FB	**VB00208-0007-5**	
					1																FB	**VB00208-0009-5**	
						1															FB	**VB00210-0012-5**	
							1														FB	**VB00213-0016-5**	
								1													FB	**VB00213-0022-5**	
									1												FB	**VB00213-0031-5**	
										1											FB	**VB00216-0038-5**	
											1										FB	**VB00216-0045-5**	
												1									FB	**VB00216-0061-5**	
													1								FB	**VB00219-0072-5**	
														1							FB	**VB00219-0087-5**	
															1						FB	**VB00219-0105-5**	
																1					FB	**VB00236-0140-5**	
																	1				FB	**VB00236-0168-5**	
																		1			FB	**VB00236-0205-5**	
Electrolytic Capacitors																							
	2	2	2	2																	W	**PP01000**	
					2	2															W	**PP01001**	
							2	2													W	**PP01002**	
									2												W	**PP01003**	
										2	2	2									W	**PP01004**	
													2	2	2	4	4	4	8	8	W	**PP01005**	

② I_L only; has no corresponding I_H rated hp rating.

Discount Symbol **SS-2**

Table 40-118. 9000X Series Replacement Parts — FR4 – FR9 SVX9000 Drives, 380 – 500V (Continued)

Frame:	4						5			6			7			8			9		Delivery Code	Catalog Number	Price U.S. $
hp (I_H):	1	1-1/2	2	3	5	7-1/2 ①	7-1/2	10	15	20	25	30	40	50	60	75	100	125	150	200			
Cooling Fans																							
	1	1	1	1	1	1															W	**PP01060**	
							1	1	1												W	**PP01061**	
										1	1	1									W	**PP01062**	
													1	1	1						W	**PP01063**	
																1	1	1			FC	**PP01123** ②	
																			1	1	FC	**PP01080** ③	
	1	1	1	1	1	1															W	**PP01086**	
							1	1	1												FC	**PP01088**	
										1	1	1	1	1	1						W	**PP01049**	
																1	1	1			FC	**CP01180**	
																			1 ④	2	W	**PP01068**	
																			1	1	FC	**PP09051**	
IGBT Modules																							
	1	1	1																		W	**CP01304**	
				1	1																W	**CP01305**	
						1	1														W	**CP01306**	
								1													W	**CP01307**	
									1												W	**CP01308**	
										1											W	**PP01020**	
											1										W	**PP01022**	
												1									W	**PP01023**	
													1								W	**PP01024**	
														1							W	**PP01025**	
															1						W	**PP01029**	
																1					W	**PP01026**	
																	1	1			W	**PP01027**	
Chopper/Rectifiers																							
										1	1										W	**CP01367**	
												1									W	**CP01368**	
Diode/Thyristor Modules																							
													3	3	3						W	**PP01035**	
																3	3	3			W	**CP01268**	
																			3	3	W	**PP01037**	
Rectifying Boards																							
													1	1	1						W	**VB00242**	
																1	1	1			W	**VB00227**	
																			1	1	W	**VB00459**	
Rectifying Module Sub-assembly																							
																			1	1	W	**FR09810**	
Power Module Sub-assemblies																							
																			1		W	**FR09-150-4-ANS** ⑤	
																				1	W	**FR09-200-4-ANS** ⑤	

① I_L only; has no corresponding I_H rated hp rating.
② PP00061 capacitor not included in main fan; please order separately.
③ PP00011 capacitor not included in main fan; please order separately.
④ For FR9 NEMA Type 12 you need two PP01068 internal fans.
⑤ See **Table 40-122** for details.

Discount Symbol........................ **SS-2**

Table 40-119. 9000X Series Replacement Parts — FR10 – FR12 SVX9000 Drives, 380 – 500V

Frame:	10			11			12			Delivery Code	Catalog Number	Price U.S. $
hp (I_H):	250	300	350	400	500	550	600	650	700			
Control Board												
	1	1	1	1	1	1	1	1	1	W	**VB00561** ①	
Shunt Boards												
	6									FC	**VB00537**	
		6								FC	**VB00497**	
			6				12	12	12	FC	**VB00498**	
				9						FC	**VB00538**	
					9					FC	**VB00513**	
						9				FC	**VB00514**	
Driver Boards												
				3	3	3				FC	**VB00489**	
	1	1	1				2	2	2	FC	**VB00487**	
Driver Adapter Board												
	1	1	1				2	2	2	FC	**VB00330**	
ASIC Board												
	1	1	1	1	1	1	2	2	2	FC	**VB00451**	
Feedback Interface Board												
							2	2	2	FC	**VB00448**	
Star Coupler Board												
							1	1	1	FC	**VB00336**	
Power Modules												
	1	1	1	2	2	2	2	2	2	FC	**FR10820** ②	
	2	2	2							FC	**FR10828**	
	1									FC	**FR10-250-4-ANS** ③	
		1								FC	**FR10-300-4-ANS** ③	
			1				2	2	2	FC	**FR10-350-4-ANS** ③	
				3						FC	**FR11-400-4-ANS** ③	
					3					FC	**FR11-500-4-ANS** ③	
						3				FC	**FR11-550-4-ANS** ③	
Electrolytic Capacitors												
	2	2	2	3	3	3	4	4	4	FC	**PP00060**	
	12	12	12	18	18	18	24	24	24	FC	**PP01005**	
Fuses												
	1	1	1	1	1	1	2	2	2	FC	**PP01094**	
	2	2	2	2	2	2	4	4	4	FC	**PP01095**	
Cooling Fans and Isolation Transformers												
	2	2	2	3	3	3	4	4	4	FC	**VB00299**	
	2	2	2	3	3	3	4	4	4	FC	**PP01080** ④	
	2	2	2				4	4	4	FC	**PP01068**	
	1	1	1	1	1	1	2	2	2	FC	**PP01096**	
	1	1	1				2	2	2	FC	**FR10844**	
	1	1	1	3	3	3	2	2	2	FC	**FR10845**	
	1	1	1				2	2	2	FC	**FR10846**	
	1	1	1	3	3	3	2	2	2	FC	**FR10847**	
Rectifying Board												
	1	1	1	2	2	2	2	2	2	FC	**VB00459**	

① SPX9000 Drives only (FR10 and larger).
② Rectifying board not included.
③ See **Table 40-122** for details.
④ PP00060 capacitor not included in main fan; please order separately.

Discount Symbol **SS-2**

Table 40-120. 9000X Series Replacement Parts — FR6 – FR9 SVX9000 Drives, 525 – 690V

Frame:	6									7		8			9				Delivery Code	Catalog Number	Price U.S. $
hp (I_H):	2	3	5 ①	5	7-1/2	10	15	20	25	30	40	50	60	75	100	125	150	200 ①			
Control Board																					
	1	1	1	1	1	1	1	1	1	1	1					1	1	1	W	VB00252	
Driver Board																					
	1																		FB	VB00404-0004-6	
		1																	FB	VB00404-0005-6	
			1																FB	VB00404-0007-6	
				1															FB	VB00404-0010-6	
					1														FB	VB00404-0013-6	
						1													FB	VB00404-0018-6	
							1												FB	VB00404-0022-6	
								1											FB	VB00404-0027-6	
									1										FB	VB00404-0034-6	
Power Boards																					
										1									FB	VB00419-0041-6	
											1								FB	VB00419-0052-6	
												1							FB	VB00422-0062-6	
													1						FB	VB00422-0080-6	
														1					FB	VB00422-0100-6	
Power Modules																					
															1				FC	FR09-100-5-ANS ②	
																1			FC	FR09-125-5-ANS ②	
																	1		FC	FR09-150-5-ANS ②	
																		1	FC	FR09-175-5-ANS ②	
Electrolytic Capacitors																					
	2	2	2	2	2	2	2	2	2										FC	PP01093	
										2	2	4	4		8	8	8	8	FC	PP01041	
														4					FC	PP01040	
Fuses																					
												1	1	1	1	1	1	1	W	PP01094	
												2	2	2	2	2	2	2	W	PP01095	
Cooling Fans																					
	1	1	1	1	1														W	PP01061	
						1	1	1	1										W	PP01062	
										1	1								W	PP01063	
												1	1	1					FC	PP01123	
	1	1	1	1	1	1	1	1	1	1	1								W	PP01049	
												1	1	1					FC	CP01180	
															1	1	1	1 ③	W	PP01068	
															1	1	1	1	FC	PP01080	
Fan Power Supply																					
																1	1	1	FC	VB00299	
IGBT Modules																					
	3	3	3	3	3	3	3	3	3										FC	PP01091	
										1	1								FC	PP01089	
												1	1	1					FC	PP01127	
IGBT/Diode (Brake)																					
	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	FC	PP01040	
Diode Module																					
	1	1	1	1	1	1	1	1	1										FC	PP01092	
Diode/Thyristor Modules																					
										3	3								FC	PP01071	
															3	3	3	3	FC	PP01072	
Rectifying Boards																					
										1	1								FC	VB00442	
															1	1	1	1	FC	VB00460	
Rectifying Module Sub-assemblies																					
																1	1	1	W	FR09810	
																1	1	1	FC	FR09811	

① I_L only; has no corresponding I_H rated hp rating.
② See **Table 40-122** for details.
③ For NEMA Type 12, two PP01068 internal fans are needed.

Discount Symbol **SS-2**

EATON

Table 40-121. 9000X Series Replacement Parts — FR10 – FR12 SVX9000 Drives, 525 – 690V

Frame:	10			11			12			Delivery Code	Catalog Number	Price U.S. $
hp (I_H):	200	250	300	400	450	500	550	600	700			
Component Boards												
	1	1	1	1	1	1	1	1	1	W	**VB00561** ①	
	1	1	1	1	1	1	2	2	2	FC	**VB00451**	
	6									FC	**VB00545**	
		6								FC	**VB00510**	
			6				12	12	12	FC	**VB00511**	
	1	1	1				2	2	2	FC	**VB00330**	
	1	1	1				2	2	2	FC	**VB00487**	
				3	3	3				FC	**VB00489**	
				9						FC	**VB00546**	
					9					FC	**VB00547**	
						9				FC	**VB00512**	
							2	2	2	FC	**VB00448**	
							1	1	1	FC	**VB00336**	
Power Modules												
	1	1	1	2	2	2	2	2	2	FC	**FR10821** ②	
	2	2	2							FC	**FR10829**	
	1									FC	**FR10-200-5-ANS** ③	
		1								FC	**FR10-250-5-ANS** ③	
			1				2	2	2	FC	**FR10-300-5-ANS** ③	
				3						FC	**FR11-400-5-ANS** ③	
					3					FC	**FR11-450-5-ANS** ③	
						3				FC	**FR11-500-5-ANS** ③	
Electrolytic Capacitors												
	2	2	2	3	3	3	4	4	4	FC	**PP00060**	
	12	12	12	18	18	18	24	24	24	FC	**PP01099**	
Fuses												
	1	1	1	1	1	1	2	2	2	FC	**PP01094**	
	2	2	2	2	2	2	4	4	4	FC	**PP01095**	
Cooling Fans and Isolation Transformers												
	2	2	2	3	3	3	4	4	4	FC	**VB00299**	
	2	2	2	3	3	3	4	4	4	FC	**PP01080** ④	
	2	2	2				4	4	4	FC	**PP01068**	
	1	1	1	1	1	1	2	2	2	FC	**PP01096**	
	1	1	1				2	2	2	FC	**FR10844**	
	1	1	1	3	3	3	2	2	2	FC	**FR10845**	
	1	1	1				2	2	2	FC	**FR10846**	
	1	1	1	3	3	3	2	2	2	FC	**FR10847**	
Fan Power Supply												
							1	1	1	FC	**VB00299**	
Rectifying Boards												
	1	1	1	2	2	2	2	2	2	FC	**VB00460**	

① SPX9000 Drives only (FR10 and larger).
② Rectifying board not included.
③ See **Table 40-122** for details.
④ PP00060 capacitor not included in main fan; please order separately.

Table 40-122. Power Module Catalog Number Matrix

FR10 – 000 – 4 – A N S

Frame Code

Horsepower
Example: **150** = 150 hp (See **Table 40-72** on **Page 40-53**.)

Voltage
4 = 380 – 500V
5 = 525 – 690V

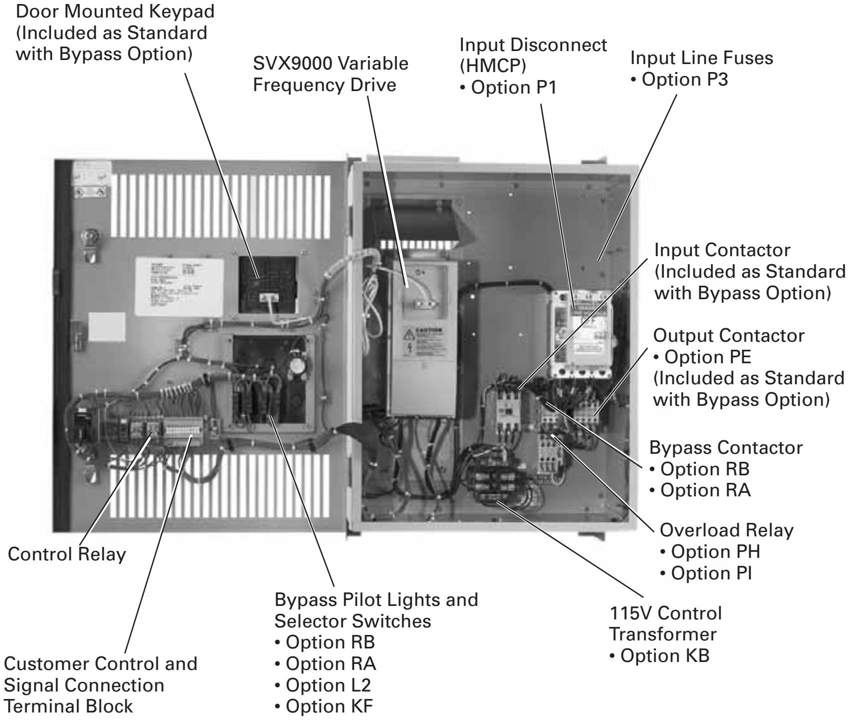
Cooling Type
A = Air

Brake Option
N = No Brake Chopper
B = Brake Chopper

Varnishing
S = Standard **V** = Varnished

Discount Symbol **SS-2**

SVX9000 Enclosed Drives



Enclosed 9000X Series Drive

Standards and Certifications

- UL Listed
- cUL Listed

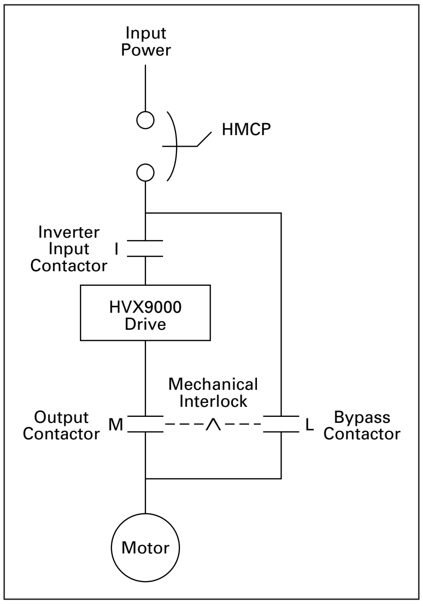


Figure 40-40. Power Diagram for Bypass Options RB and RA

Product Description

- **Standard Enclosed** — covers a wide range of the most commonly ordered options. Pre-engineering eliminates the lead time normally associated with customer specific options.
- **Modified Standard Enclosed** — applies to specific customer requirements that vary from the Standard Enclosed offering, such as the need for an additional indicating light or minor modifications to drawings. *Consult your Eaton representative for assistance in pricing and lead time.*
- **Custom Engineered** — for those applications with more unique or complex requirements, these are individually engineered to the customer's needs. *Consult your Eaton representative for assistance in pricing and lead time.*

Features

- NEMA Type 1 or Type 12 enclosures
- Input Voltage: 208V, 230V, 480V and 575V (Consult Factory)
- Complete range of control, network and power options
- Horsepower range:
  - 208V — 3/4 to 100 hp I_H; 1 to 100 hp I_L
  - 230V — 3/4 to 100 hp I_H; 1 to 100 hp I_L
  - 480V — 1 to 700 hp I_H; 1-1/2 to 800 hp I_L
- HMCP padlockable

Technical Data and Specifications

Table 40-123. Specifications

Feature Description	9000X Enclosed Products — NEMA Type 1 or NEMA Type 12
Primary Design Features	
45 – 66 Hz Input Frequency	Standard
Output: AC Volts Maximum	Input Voltage Base
Output Frequency Range: Hz	0 – 320
Initial Output Current (I_H)	250% for 2 seconds
Overload: 1 Minute (I_H/I_L)	150%/110%
Enclosure Space Heater	Optional
Oversize Enclosure	Standard
Output Contactor	Optional
Bypass Motor Starter	Optional
Listings	UL, cUL
Protection Features	
Incoming Line Fuses	Optional
AC Input Circuit Disconnect	Optional
Line Reactors	Standard
Phase Rotation Insensitive	Standard
EMI Filter	Standard
Input Phase Loss Protection	Standard
Input Overvoltage Protection	Standard
Line Surge Protection	Standard
Output Short Circuit Protection	Standard
Output Ground Fault Protection	Standard
Output Phase Protection	Standard
Overtemperature Protection	Standard
DC Overvoltage Protection	Standard
Drive Overload Protection	Standard
Motor Overload Protection	Standard
Programmer Software	Optional
Local/Remote Keypad	Standard
Keypad Lockout	Standard
Fault Alarm Output	Standard
Built-In Diagnostics	Standard
Input/Output Interface Features	
Setup Adjustment Provisions: Remote Keypad/Display Personal Computer	 Standard Standard
Operator Control Provisions: Drive Mounted Keypad/Display Remote Keypad/Display Conventional Control Elements Serial Communications 115V AC Control Circuit	 Standard Standard Standard Optional Optional
Speed Setting Inputs: Keypad 0 – 10V DC Potentiometer/Voltage Signal 4 – 20 mA Isolated 4 – 20 mA Differential 3 – 15 psig	 Standard Standard Configurable Configurable Optional
Analog Outputs: Speed/Frequency Torque/Load/Current Motor Voltage Kilowatts 0 – 10V DC Signals 4 – 20 mA DC Signals Isolated Signals	 Standard Programmable Programmable Programmable Configurable w/Jumpers Standard Optional

Feature Description	9000X Enclosed Products — NEMA Type 1 or NEMA Type 12
Input/Output Interface Features (Continued)	
Discrete Outputs: Fault Alarm Drive Running Drive at Set Speed Optional Parameters Dry Contacts Open Collector Outputs Additional Discrete Outputs	 Standard Standard Programmable 14 1 (2 Relays Form C) 1 Optional
Communications: RS-232 RS-422/485 DeviceNet™ Modbus RTU CanOpen (Slave) Profibus-DP Lonworks® Johnson Controls Metasys™ N2	 Standard Optional Optional Optional Optional Optional Optional Optional
Performance Features	
Sensorless Vector Control	Standard
Volts/Hertz Control	Standard
IR and Slip Compensation	Standard
Electronic Reversing	Standard
Dynamic Braking	Optional ①
DC Braking	Standard
PID Setpoint Controller	Programmable
Critical Speed Lockout	Standard
Current (Torque) Limit	Standard
Adjustable Acceleration/Deceleration	Standard
Linear or S Curve Accel/Decel	Standard
Jog at Preset Speed	Standard
Thread/Preset Speeds	7
Automatic Restart	Selectable
Coasting Motor Start	Standard
Coast or Ramp Stop Selection	Standard
Elapsed Time Meter	Optional
Carrier Frequency Adjustment	1 – 16 kHz
Standard Conditions for Application and Service	
Operating Ambient Temperature	0 – 40°C
Storage Temperature	-40 – 60°C
Humidity (Maximum), Non-condensing	95%
Altitude (Maximum without Derate)	3300 ft. (1000m)
Line Voltage Variation	+10/-15%
Line Frequency Variation	45 – 66 Hz
Efficiency	>96%
Power Factor (Displacement)	>.94

① Some horsepower units include dynamic braking chopper as standard — refer to individual drive sections.

Table 40-124. Standard I/O Specifications

Description	Specification
6 – Digital Input Programmable	24V: "0" ≤ 10V, "1" ≥ 18V, R_i > 5 kΩ
2 – Analog Input Configurable w/Jumpers	Voltage: 0 – ±10V, R_i > 200 kΩ Current: 0 (4) – 20 mA, R_i = 250 kΩ
2 – Digital Output Programmable	Form C Relays 250V AC 2 Amp or 30V DC2 Amp resistive
1 – Digital Output Programmable	Open collector 48V DC 50 mA
1 – Analog Output Programmable Configurable w/Jumper	0 – 20 mA, impedance 500 ohms, resolution 106 ±3%

Catalog Number Selection

Table 40-125. SVX9000 Enclosed NEMA Type 1/12 Drive Catalog Numbering System

Build Alphabetically and Numerically

SVX F07 1 4 A A _ _ _ _ _ _ _ _ _ _

Product Family
SVX = Enclosed Drives

Horsepower Rating		
F07 = 3/4 hp	**025** = 25 hp	**250** = 250 hp
001 = 1 hp	**030** = 30 hp	**300** = 300 hp
F15 = 1-1/2 hp	**040** = 40 hp	**350** = 350 hp
002 = 2 hp	**050** = 50 hp	**400** = 400 hp
003 = 3 hp	**060** = 60 hp	**500** = 500 hp
005 = 5 hp	**075** = 75 hp	**550** = 550 hp
007 = 7-1/2 hp	**100** = 100 hp	**600** = 600 hp
010 = 10 hp	**125** = 125 hp	**650** = 650 hp
015 = 15 hp	**150** = 150 hp	**700** = 700 hp
020 = 20 hp	**200** = 200 hp	**800** = 800 hp

Enclosure Rating
1 = NEMA Type 1
2 = NEMA Type 12
6 = NEMA 12 Filtered

Voltage Rating
1 = 208V
2 = 230V
4 = 480V

Application — Torque/Braking [2]
A = I_L/No Brake Chopper
B = I_L/Internal Brake Chopper
D = I_H/No Brake Chopper
E = I_H/Internal Brake Chopper

Enclosed Style
A = Enclosed Drive

	Enclosed Options [1][4][5]	Type
K1	Door-Mounted Speed Potentiometer [3]	Control
K2	Door-Mounted Speed Potentiometer with HOA Selector Switch [3]	Control
K3	3 – 15 psig Follower	Control
K4	HAND/OFF/AUTO Switch (22 mm)	Control
K5	MANUAL/AUTO Ref Switch (22 mm)	Control
K6	START/STOP Pushbuttons (22 mm)	Control
KB	115V Control Transformer – 550 VA	Control
KF	Bypass Test Switch for RA and RB	Addl. Bypass
KO	Standard Elapsed Time Meter	Control
L1	Power On and Fault Pilot Lights	Light
L2	Bypass Pilot Lights for RA, RB Bypass Options	Addl. Bypass
LA	Green RUN Light (22 mm)	Light
LD	Green STOP Light (22 mm)	Light
LE	Red RUN Light	Light
LF	Red STOP Light (22 mm)	Light
LJ	White Power On Light (22 mm)	Light
LU	Misc. Light (22 mm)	Light
P1	Input Disconnect (HMCP) 100 kAIC	Input
P2	Disconnect Switch [7]	Input
P3	Input Line Fuses (200 kAIC)	Input
P7	Input Power Surge Protection	Input
PE	Output Contactor	Output
PF	Output Filter	Output
PG	MotoRx (Up to 600 Ft.) 1000 V/µS DV/DT Filter	Output
PH	Single Overload Relay	Output
PI	Dual Overload Relays	Output
PN	Dual Overloads for Bypass	Addl. Bypass
RA	Manual HOA Bypass Controller	Bypass
RB	Manual IOB Bypass Controller	Bypass
RC	Auto Transfer HOA Bypass Controller	Bypass
RD	Auto Transfer IOB Bypass Controller	Bypass
S5	Floor Stand 22"	Enclosure
S6	Floor Stand 12"	Enclosure
S7	10" Expansion	Enclosure
S8	20" Expansion	Enclosure
S9	Space Heater	Enclosure

Communication Options [6]		
C2 = Modbus	**C6** = CanOpen (Slave)	**CA** = Johnson Controls N2
C3 = Profibus DP	**C7** = DeviceNet	**CI** = Modbus TCP
C4 = LonWorks	**C8** = Modbus (D9 Type Connector)	**CJ** = BACnet
C5 = Profibus DP (D9 Connector)		**CK** = Ethernet IP
		D3 = RS-232 with D9 Connection

Control Options	
B1 = 6 DI, 1 ext +24V DC/EXT +24V DC	**B5** = 3 RO (NO)
B2 = 1 RO (NC/NO), 1 RO (NO), 1 Therm	**B8** = 1 ext +24V DC/EXT +24V DC, 3 Pt100
B4 = 1 AI (mA isolated), 2 AO (mA isolated), 1 ext +24V DC/EXT +24V DC	**B9** = 1 RO (NO), 5 DI 42 – 240V AC Input

	Engineered Options
HT	High Temperature rating for 50°C (FR10 and above) [8]
VB	Varnished Boards

[1] Local/Remote keypad is included as the standard Control Panel.
[2] Brake Chopper is a factory installed option only, see drive option tables on **Pages 40-92** – **40-100**. **Note:** External dynamic braking resistors not included. Consult factory.
[3] Includes local/remote speed reference switch.
[4] Some options are voltage and/or horsepower specific. Consult your Eaton representative for details.
[5] See **Pages 40-88** and **40-89** for descriptions.
[6] See **Pages 40-90** and **40-91** for complete descriptions.
[7] Applicable only with FR10 and FR11 Freestanding designs.
[8] Consult Eaton for availability.

Control/Communication Option Descriptions

Table 40-126. Available Control/Communications Options

Option	Description	Option Type
K1	**Door-Mounted Speed Potentiometer** — Provides the SVX9000 with the ability to adjust the frequency reference using a door-mounted potentiometer. This option uses the 10V DC reference to generate a 0 – 10V signal at the analog voltage input signal terminal. When the HOA bypass option is added, the speed is controlled when the HOA switch is in the hand position. Without the HOA bypass option, a 2-position switch (labeled local/remote) is provided on the keypad to select speed reference from the Speed Potentiometer or a remote speed signal.	Control
K2	**Door-Mounted Speed Potentiometer with HOA Selector Switch** — Provides the SVX9000 with the ability to start/stop and adjust the speed reference from door-mounted control devices or remotely from customer supplied inputs. In HAND position, the drive will start and the speed is controlled by the door-mounted speed potentiometer. The drive will be disabled in the OFF position. When AUTO is selected, the drive run and speed control commands are via user-supplied dry contact and 4 – 20 mA signal.	Control
K3	**3 – 15 psig Follower** — Provides a pneumatic transducer which converts a 3 – 15 psig pneumatic signal to either 0 – 8V DC or a 1 – 9V DC signal interface with the SVX9000. The circuit board is mounted on the inside of the front enclosure panel and connects to the user's pneumatic control system via 6 ft. (1.8m) of flexible tubing and a 1/4 inch (6.4 mm) brass tube union.	Control
K4	**HAND/OFF/AUTO Switch for Non-bypass Configurations** — Provides a three-position selector switch that allows the user to select either a Hand or Auto mode of operation. Hand mode is defaulted to keypad operation, and Auto mode is defaulted to control from an external terminal source. These modes of operation can be configured via programming to allow for alternate combinations of start and speed sources. Start and speed sources include Keypad, I/O and FieldBus.	Control
K5	**MANUAL/AUTO Speed Reference Switch** — Provides a door-mounted selector switch for Manual/Auto speed reference.	Control
K6	**START/STOP Pushbuttons** — Provides door-mounted START and STOP pushbuttons for either bypass or non-bypass configurations.	Control
KB	**115V Control Transformer – 550 VA** — Provides a fused control power transformer with additional 550 VA at 115V for customer use.	Control
KF	**Bypass Test Switch for RB and RA** — Allows the user to energize the AF drive for testing while operating the motor on the bypass controller. The Test Switch is mounted on the inside of the enclosure door.	Addl. Bypass
KO	**Standard Elapsed Time Meter** — Provides a door-mounted elapsed run time meter.	Control
L1	**Power On and Fault Pilot Lights** — Provides a white power on light that indicates power to the enclosed cabinet and a red fault light indicates a drive fault has occurred.	Light
L2	**Bypass Pilot Lights for RB, RA Bypass Options** — A green light indicates when the motor is running in inverter mode and an amber light indicates when the motor is running in bypass mode. The lights are mounted on the enclosure door, above the switches.	Addl. Bypass
LA	**Green RUN Light (22 mm)** — Provides a green run light that indicates the drive is running.	Light
LD	**Green STOP Light (22 mm)** — Provides a green stop light that indicates the drive is stopped.	Light
LE	**Red Run Pilot Light (22 mm)** — Provides a red run pilot light that indicates the drive is running.	Light
LF	**Red STOP Light (22 mm)** — Provides a red stop light that indicates the drive is stopped.	Light
LJ	**White Power On Light (22 mm)** — The 22 mm white light that illuminates when the drive assembly is powered.	Light
LU	**Misc. Light (22 mm)** — Provides a misc. "user defined" pilot light. User to define light function and color.	Light
P1	**Input Disconnect Assembly Rated to 100 kAIC** — High Interrupting Motor Circuit Protector (HMCP) that provides a means of short circuit protection for the power cables between it and the SVX9000, and protection from high-level ground faults on the power cable. Allows a convenient means of disconnecting the SVX9000 from the line and the operating mechanism can be padlocked in the OFF position. This is factory mounted in the enclosure.	Input
P2	**Disconnect Switch** — Disconnect switch option is applicable only with NEMA Type 1 and NEMA Type 12 Freestanding drives. Allows a convenient means of disconnecting the SVX9000 from the line, and the operating mechanism can be padlocked in the OFF position. This is factory-mounted in the enclosure.	Input
P3	**Input Line Fuses Rated to 200 kAIC** — Provides high-level fault protection of the SVX9000 input power circuit from the load side of the fuses to the input side of the power transistors. This option consists of three 200 kA fuses, which are factory mounted in the enclosure.	Input
P7	**MOV Surge Suppressor** — Provides a Metal Oxide Varistor (MOV) connected to the line side terminals and is designed to clip line side transients.	Input
PE	**Output Contactor** — Provides a means for positive disconnection of the drive output from the motor terminals. The contactor coil is controlled by the drive's run or permissive logic. NC and NO auxiliary contacts rated at 10A, 600V AC are provided for customer use. Bypass Options **RB** and **RA** include an Output Contactor as standard. This option includes a low VA 115V AC fused Control Power Transformer and is factory mounted in the enclosure.	Output
PF	**Output Filter** — Used to reduce the transient voltage (DV/DT) at the motor terminals. The Output Filter is recommended for cable lengths exceeding 100 ft. (30m) with a drive of 3 hp and above, for cable lengths of 33 ft. (10m) with a drive of 2 hp and below, or for a drive rated at 525 – 690V. This option is mounted in the enclosure, and may be used in conjunction with a Brake Chopper Circuit.	Output
PG	**MotoRx (300 – 600 Ft.) 1000 V/µS DV/DT Filter** — Used to reduce transient voltage (DV/DT) and peak voltages at the motor terminals. This option is comprised of a .5% line reactor, followed by capacitive filtering and an energy recovery/clamping circuit. Unlike the Output Filter (See option **PF**), the MotoRx recovers most of the energy from the voltage peaks, resulting in a lower voltage drop to the motor, and therefore conserving power. This option is used when the distance between a single motor and the drive is 300 – 600 feet (91 – 183m). *This option can not be used with the Brake Chopper Circuit. The Output Filter (option **PF**) should be investigated as an alternative.*	Output
PH	**Single Overload Relay** — Uses a bimetallic overload relay to provide additional overload current protection to the motor on configurations without bypass options. It is included with the Bypass Configurations for overload current protection in the bypass mode. The Overload Relay is mounted within the enclosure, and is manually resettable. Heater pack included.	Output

Table 40-126. Available Control/Communications Options (Continued)

Option	Description	Option Type
PI	**Dual Overload Relays** — This option is recommended when a single drive is operating 2 motors and overload current protection is needed for each of the motors. The standard configuration includes two bimetallic overload relays, each sized to protect a motor with 50% of the drive hp rating. For example, a 100 hp drive would include two overload relays sized to protect two 50 hp motors. The relays are mounted within the enclosure, and are manually resettable. Heater packs not included.	Output
PN	**Dual Overloads for Bypass** — This option is recommended when a single drive is operating 2 motors in the bypass mode and overload current protection is needed for each of the motors. The standard configuration includes two bimetallic overload relays, each sized to protect a motor with 50% of the drive hp rating. For example, a 100 hp drive would include two overload relays sized to protect two 50 hp motors. The relays are mounted within the enclosure, and are manually resettable.	Addl. Bypass
RA	**Manual HOA Bypass Controller** — The Manual HAND/OFF/AUTO (HOA) — 3-contactor — bypass option provides a means of bypassing the SVX9000, allowing the AC motor to be operated at full speed directly from the AC supply line. This option consists of an input disconnect, a fused control power transformer, and a full voltage bypass starter with a door mounted HOA selector switch and an INVERTER/BYPASS switch. The HOA switch provides the ability to start and stop the drive in the inverter mode. For applications up to 100 hp, a Freedom Series IEC input contactor, a Freedom Series IEC output contactor, and a Freedom Series IEC starter with a bimetallic overload relay is included. For applications above 100 hp, an Advantage input contactor, an Advantage output contactor and an Advantage starter with electronic overload protection is included. The contactors are mechanically and electrically interlocked (see power diagram on **Page 40-85**).	Bypass
RB	**Manual IOB Bypass Controller** — The Manual INVERTER/OFF/BYPASS (IOB) — 3-contactor — bypass option provides a means of bypassing the SVX9000, allowing the AC motor to be operated at full speed directly from the AC supply line. This option consists of an input disconnect, a fused control power transformer, and a full voltage bypass starter with a door mounted IOB selector switch. For applications up to 100 hp, a Freedom Series IEC input contactor, a Freedom Series IEC output contactor, and a Freedom Series IEC starter with a bimetallic overload relay is included. For applications above 100 hp, an Advantage input contactor, an Advantage output contactor and an Advantage starter with electronic overload protection is included. The contactors are mechanically and electrically interlocked (see power diagram on **Page 40-85**).	Bypass
RC	**Auto Transfer HOA Bypass Controller** – The Manual HAND/OFF/AUTO (HOA) — 3-contactor — bypass option provides a means of bypassing the SVX9000, allowing the AC motor to be operated at full speed directly from the AC supply line. The circuitry provides an automatic transfer of the load to “across the line” operation after a drive trip. This option consists of an input disconnect, a fused control power transformer, and a full voltage bypass starter with a door mounted HOA selector switch and an INVERTER/BYPASS switch. The HOA switch provides the ability to start and stop the drive in either mode. For applications up to 100 hp, a Freedom Series IEC input contactor, a Freedom Series IEC output contactor, and a Freedom Series IEC starter with a bimetallic overload relay is included. For applications above 100 hp, an Advantage input contactor, an Advantage output contactor and an Advantage starter with electronic overload protection is included. The contactors are mechanically and electrically interlocked (see power diagram on **Page 40-85**). Door-mounted pilot lights are provided which indicate bypass or inverter operation. A green light indicates when the motor is running in inverter mode and an amber light indicates when the motor is running in bypass mode. **WARNING**: The motor may restart when the overcurrent relay is reset when operating in bypass, unless the IOB selector switch is turned to the OFF position.	Bypass
RD	**Auto Transfer IOB Bypass Controller** — The Auto INVERTER/OFF/BYPASS (IOB) — 3-contactor — bypass option provides a means of bypassing the SVX9000, allowing the AC motor to be operated at full speed directly from the AC supply line. The circuitry provides an automatic transfer of the load to “across the line” operation after a drive trip. This option consists of an input disconnect, a fused control power transformer, and a full voltage bypass starter with a door mounted IOB selector switch. For applications up to 100 hp, a Freedom Series IEC input contactor, a Freedom Series IEC output contactor, and a Freedom Series IEC starter with a bimetallic overload relay is included. For applications above 100 hp, an Advantage input contactor, an Advantage output contactor and an Advantage starter with electronic overload protection is included. The contactors are mechanically and electrically interlocked (see power diagram on **Page 40-85**). Door-mounted pilot lights are provided which indicate bypass or inverter operation. A green light indicates when the motor is running in inverter mode and an amber light indicates when the motor is running in bypass mode. **WARNING**: The motor may restart when the overcurrent relay is reset when operating in bypass, unless the IOB selector switch is turned to the OFF position.	Bypass
S5	**Floor Stand 22"** — Converts a Size 1 or 2, normally wall mounted enclosure to a floor standing enclosure with a height of 22" (558.8 mm).	Enclosure
S6	**Floor Stand 12"** — Converts a Size 2, normally wall mounted enclosure to a floor standing enclosure with a height of 12" (304.8 mm).	Enclosure
S7	**10" Expansion** — In a Size 5 enclosure, the extension allows for bottom cable entry and additional space for customer mounted components. **NOTE:** Enclosure expansion rated NEMA Type 1 only.	Enclosure
S8	**20" Expansion** — In a Size 5 enclosure, the extension allows for bottom cable entry and additional space for customer mounted components. When the Output Filter (option **PF**) is selected for a drive using a Size 5 enclosure, this expansion box is required and included in the option pricing. **NOTE:** Enclosure expansion rated NEMA Type 1 only.	Enclosure
S9	**Space Heater** — Prevents condensation from forming in the enclosure when the drive is inactive or in storage. Includes a thermostat for variable temperature control. A 200W heater is installed in enclosures 0 and 1, and a 400W heater is installed in enclosures 2 – 5. Requires a customer supplied 115V remote supply source.	Enclosure

Note: For availability, see Product Selection for base drive voltage required.

9000X Series Option Board Kits

The 9000X Series drives can accommodate a wide selection of expander and adapter option boards to customize the drive for your application needs. The drive's control unit is designed to accept a total of five option boards (see **Figure 40-41**).

The 9000X Series factory installed standard board configuration includes an A9 I/O board and an A2 relay output board, which are installed in slots A and B.

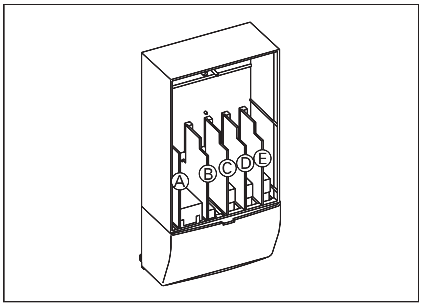


Figure 40-41. 9000X Series Option Boards

Table 40-127. Option Board Kits

Option Kit Description ②	Allowed Slot Locations ①	Field Installed		Factory Installed		SVX Ready Programs						
		Catalog Number	Price U.S. $	Option Designator	Adder U.S. $	Basic	Local/ Remote	Standard	MSS	PID	Multi-P.	PFC
Standard I/O Cards (See Figure 40-41)												
2 RO (NC/NO)	B	**OPTA2**		**—**		X	X	X	X	X	X	X
6 DI, 1 DO, 2 AI, 1AO, 1 +10V DC ref, 2 ext +24V DC/ EXT +24V DC	A	**OPTA9**		**—**		X	X	X	X	X	X	X
Extended I/O Card Options												
2 RO, Therm — SPX Only	B	**OPTA3**		**A3**		—	X	X	X	X	X	X
Encoder low volt +5V/15V/24V — SPX Only	C	**OPTA4**		**A4**		—	X	X	X	X	X	X
Encoder high volt +15V/24V — SPX Only	C	**OPTA5**		**A5**		—	X	X	X	X	X	X
Double encoder — SPX Only	C	**OPTA7**		**A7**		X	X	X	X	X	X	X
6 DI, 1 DO, 2 AI, 1 AO — SPX Only	A	**OPTA8**		**A8**		—	X	X	X	X	X	X
3 DI (Encoder 10 – 24V), Out +15V/+24V, 2 DO (pulse+direction) — SPX Only	C	**OPTAE**		**AE**		X	X	X	X	X	X	X
6 DI, 1 ext +24V DC/EXT +24V DC	B, C, **D**, E	**OPTB1**		**B1**		—	—	—	—	—	X	X
1 RO (NC/NO), 1 RO (NO), 1 Therm	B, C, **D**, E	**OPTB2**		**B2**		—	—	—	—	—	X	X
1 AI (mA isolated), 2 AO (mA isolated), 1 ext +24V DC/EXT +24V DC	B, C, **D**, E	**OPTB4**		**B4**		X	X	X	X	X	X	X
3 RO (NO)	B, C, **D**, E	**OPTB5**		**B5**		—	—	—	—	—	X	X
1 ext +24V DC/EXT +24V DC, 3 Pt100	B, C, **D**, E	**OPTB8**		**B8**		—	—	—	—	—	—	—
1 RO (NO), 5 DI 42 – 240V AC Input	B,C, **D**, E	**OPTB9**		**B9**		—	—	—	—	—	X	X
Communication Cards ③												
Modbus	D, **E**	**OPTC2**		**C2**		X	X	X	X	X	X	X
Modbus TCP	D, **E**	**OPTCI**		**CI**		X	X	X	X	X	X	X
BACnet	D, **E**	**OPTCJ**		**CJ**		X	X	X	X	X	X	X
Ethernet IP	D, **E**	**OPTCK**		**CK**		X	X	X	X	X	X	X
Johnson Controls N2	D, **E**	**OPTC2**		**CA**		—	—	—	—	—	—	—
Profibus DP	D, **E**	**OPTC3**		**C3**		X	X	X	X	X	X	X
LonWorks	D, **E**	**OPTC4**		**C4**		X	X	X	X	X	X	X
Profibus DP (D9 Connector)	D, **E**	**OPTC5**		**C5**		X	X	X	X	X	X	X
CanOpen (Slave)	D, **E**	**OPTC6**		**C6**		X	X	X	X	X	X	X
DeviceNet	D, **E**	**OPTC7**		**C7**		X	X	X	X	X	X	X
Modbus (D9 Type Connector)	D, **E**	**OPTC8**		**C8**		X	X	X	X	X	X	X
Adapter — SPX Only	D, **E**	**OPTD1**		**D1**		X	X	X	X	X	X	X
Adapter — SPX Only	D, **E**	**OPTD2**		**D2**		X	X	X	X	X	X	X
RS-232 with D9 Connection	D, **E**	**OPTD3**		**D3**		X	X	X	X	X	X	X
Keypad												
9000X Series Local Remote Keypad	—	**KEYPAD-LOC/REM**		**—**		—	—	—	—	—	—	—
9000X Series Remote Mount Keypad Kit (Keypad not included)	—	**OPTRMT-KIT-9000X**		**—**		—	—	—	—	—	—	—
9000X Series RS-232 Cable, 13 ft.	—	**PP00104**		**—**		—	—	—	—	—	—	—

① Option card must be installed in one of the slots listed for that card. Slot indicated in Bold is the preferred location.
② AI = Analog Input; AO = Analog Output, DI = Digital Input, DO = Digital Output, RO = Relay Output
③ OPTC2 is a multi-protocol option card.

Discount Symbol........................ **SS-2**

Modbus RTU Network Communications

The Modbus Network Card OPTC2 is used for connecting the 9000X Drive as a slave on a Modbus network. The interface is connected by a 9-pin DSUB connector (female) and the baud rate ranges from 300 to 19200 baud. Other communication parameters include an address range from 1 to 247; a parity of None, Odd or Even; and the stop bit is 1.

Profibus Network Communications

The Profibus Network Card OPTC3 is used for connecting the 9000X Drive as a slave on a Profibus-DP network. The interface is connected by a 9-pin DSUB connector (female). The baud rates range from 9.6K baud to 12M baud, and the addresses range from 1 to 127.

LonWorks Network Communications

The LonWorks Network Card OPTC4 is used for connecting the 9000X Drive on a LonWorks network. This interface uses Standard Network Variable Types (SNVT) as data types. The channel connection is achieved using a FTT-10A Free Topology transceiver via a single twisted transfer cable. The communication speed with LonWorks is 78 kBits/s.

CanOpen (Slave) Communications

The CanOpen (Slave) Network Card OPTC6 is used for connecting the 9000X Drive to a host system. According to ISO11898 standard cables to be chosen for CAN bus should have a nominal impedance of 120Ω, and specific line delay of nominal 5 nS/m. 120Ω line termination resistors required for installation.

DeviceNet Network Communications

The DeviceNet Network Card OPTC7 is used for connecting the 9000X Drive on a DeviceNet Network. It includes a 5.08 mm pluggable connector. Transfer method is via CAN using a 2-wire twisted shielded cable with 2-wire bus power cable and drain. The baud rates used for communication include 125K baud, 250K baud and 500K baud.

Johnson Controls Metasys™ N2 Network Communications

The OPTC2 fieldbus board provides communication between the 9000X Drive and a Johnson Controls Metasys™ N2 network. With this connection, the drive can be controlled, monitored and programmed from the Metasys system. The N2 fieldbus is available as a factory installed option and as a field installable kit.

Modbus/TCP Network Communications

The Modbus/TCP Network Card OPTCI is used for connecting the 9000X Drive to Ethernet networks utilizing Modbus protocol. It includes an RJ-45 pluggable connector. This interface provides a selection of standard and custom register values to communicate drive parameters. The board supports 10 Mbps and 100 Mbps communication speeds. The IP address of the board is configurable over Ethernet using a supplied software tool.

BACnet Network Communications

The BACnet Network Card OPTCJ is used for connecting the 9000X Drive to BACnet networks. It includes a 5.08 mm pluggable connector. Data transfer is Master-Slave/Token Passing (MS/TP) RS-485. This interface uses a collection of 30 Binary Value Objects (BVOs) and 35 Analog Value Objects (AVOs) to communicate drive parameters. The card supports 9.6, 19.2 and 38.4 Kbaud communication speeds and supports network addresses 1 – 127.

Ethernet/IP Network Communications

The Ethernet/IP Network Card OPTCK is used for connecting the 9000X Drive to Ethernet/Industrial Protocol networks. It includes an RJ-45 pluggable connector. The interface uses CIP objects to communicate drive parameters (CIP is "Common Industrial Protocol", the same protocol used by DeviceNet). The board supports 10 Mbps and 100 Mbps communication speeds. The IP address of the board is configurable by Static, BOOTP and DHCP methods.

Table 40-128. I/O Specifications for the Control/Communication Options

Description	Specifications
Analog voltage, input	0 – ±10V, R_i ≥ 200 kΩ
Analog current, input	0 (4) – 20 mA, R_i = 250 Ω
Digital Input	24V: "0" ≤ 10V, "1" ≥ 18V, R_i > 5 kΩ
Aux. voltage	24V (±20%), max. 50 mA
Reference voltage	10V ±3%, max. 10 mA
Analog current, output Analog voltage, output	0 (4) – 20 mA, R_L = 500 kΩ, resolution 10 bit, accuracy ≤ ±2% 0 (2) – 10V, R_L ≥ 1 kΩ, resolution 10 bit, accuracy ≤ ±2%
Relay output Max. switching voltage Max. switching load Max. continuous load	 300V DC, 250V AC 8A/24V DC, .4A/300V DC, 2 kVA/250V AC 2A rms
Thermistor input	R_{trip} = 4.7 kΩ
Encoder input	24V: "0" ≤ 10V, "1" ≥18V, R_i = 2.2 kΩ 5V: "0" ≤ 2V, "1" ≥ 3V, R_i = 330 Ω

SVX Conversion Kit

Table 40-129. SVX Conversion Kit Frame 4 – 7

Frame Size	Enclosure Size	Catalog Number	Delivery Code	Price U.S. $
FR4	0	**OPTCON-SVXFR4-SZ00**	FB10	
FR4	1	**OPTCON-SVXFR4-SZ01**	FB10	
FR5	0	**OPTCON-SVXFR5-SZ00**	FB10	
FR5	1	**OPTCON-SVXFR5-SZ01**	FB10	
FR6	1	**OPTCON-SVXFR6-SZ01**	FB10	
FR6	2	**OPTCON-SVXFR6-SZ02**	FB10	
FR7	2	**OPTCON-SVXFR7-SZ02**	FB10	

Note: The kit consists of a flange kit, adapter plate(s), hardware, remote keypad kit and SVX9000 decal.

Table 40-130. Conformal (Varnished) Coating Adder — 208 – 240V, 380 – 500V ①

Frame	Delivery Code	Adder U.S. $
FR4 FR5 FR6 FR7 FR8	FP FP FP FP FP	
FR9 FR10	FP FP	
FR11 FR12	FP FP	
FR13 FR14	FP FP	

① See catalog number description to order.

Discount Symbol **SS-2**

Product Selection

When Ordering

- Select a Base Catalog Number that meets the application requirements — nominal horsepower, voltage and enclosure rating (the enclosed drive's continuous output amp rating should be equal to or greater than the motor's full load amp rating). The base enclosed package includes a standard drive, door mounted Local/Remote Keypad and enclosure.
- If Dynamic Brake Chopper or Control/Communication option is desired, change the appropriate code in the Base Catalog Number.
- Select Enclosed Options. Add the codes as suffixes to the Base Catalog Number in alphabetical and numeric order.
- **Read all Footnotes.**

208V Drives

Table 40-131. 208V AC Input Base Drive

Enclosure Size ①	hp	Current (A)	NEMA Type 1 Frame Size	NEMA Type 1 Base Catalog Number ②	NEMA Type 1 Price U.S. $ ②	NEMA Type 12 Frame Size	NEMA Type 12 Base Catalog Number ②	NEMA Type 12 Price U.S. $ ②
208V High Overload Drive and Enclosure								
0	3/4	3.7	4	SVXF0711EA		4	SVXF0721EA	
0	1	4.8	4	SVX00111EA		4	SVX00121EA	
0	1-1/2	6.6	4	SVXF1511EA		4	SVXF1521EA	
0	2	7.8	4	SVX00211EA		4	SVX00221EA	
0	3	11	4	SVX00311EA		4	SVX00321EA	
0	5	17.5	5	SVX00511EA		5	SVX00521EA	
0	7-1/2	25	5	SVX00711EA		5	SVX00721EA	
1	10	31	6	SVX01011EA		6	SVX01021EA	
1	15	48	6	SVX01511EA		6	SVX01521EA	
2	20	61	7	SVX02011DA		7	SVX02021DA	
2	25	75	7	SVX02511DA		7	SVX02521DA	
2	30	88	7	SVX03011DA		7	SVX03021DA	
3	40	114	8	SVX04011DA		8	SVX04021DA	
4	50	143	8	SVX05011DA		8	SVX05021DA	
5	60	170	8	SVX06011DA		8	SVX06021DA	
5	75	211	9	SVX07511DA		9	SVX07521DA	
5	100	273	9	SVX10011DA		9	SVX10021DA	
208V Low Overload Drive and Enclosure								
0	1	4.8	4	SVX00111BA		4	SVX00121BA	
0	1-1/2	6.6	4	SVXF1511BA		4	SVXF1521BA	
0	2	7.8	4	SVX00211BA		4	SVX00221BA	
0	3	11	4	SVX00311BA		4	SVX00321BA	
0	5	17.5	5	SVX00511BA		5	SVX00521BA	
0	7-1/2	25	5	SVX00711BA		5	SVX00721BA	
0	10	31	5	SVX01011BA		5	SVX01021BA	
1	15	48	6	SVX01511BA		6	SVX01521BA	
1	20	61	6	SVX02011BA		6	SVX02021BA	
2	25	75	7	SVX02511AA		7	SVX02521AA	
2	30	88	7	SVX03011AA		7	SVX03021AA	
2	40	114	7	SVX04011AA		7	SVX04021AA	
3	50	—	8	SVX05011AA		8	SVX05021AA	
4	60	170	8	SVX06011AA		8	SVX06021AA	
5	③	205 ③	8	SVX07511AA		8	SVX07521AA	
5	③	261 ③	9	SVX10011AA		9	SVX10021AA	

① Enclosure dimensions listed on **Pages 40-101 – 40-108.**
② Includes drive, Local/Remote Keypad and enclosure.
③ These units are current rated (75 I_L hp 205 Amps, 100 I_L hp 261 Amps). They are not hp rated.

Table 40-132. 208V Brake Chopper Adder ④

I_H hp	Adder U.S. $ NEMA Type 1/12	I_L hp	Adder U.S. $ NEMA Type 1/12
3/4		—	
1		1	
1-1/2		1-1/2	
2		2	
3		3	
5		5	
7-1/2		7-1/2	
10		10	
15		15	
20		20	
25		25	
30		30	
40		40	
50		50	
60		60	
75		75	
100		100	

④ External dynamic braking resistors not included. Consult factory.

Discount Symbol SS-3

Table 40-133. 208V Control Options

Catalog Number Suffix ➡	Door-Mounted Speed Potentiometer	Door-Mounted Speed Potentiometer with HOA Selector Switch	3 – 15 psig Follower	HAND/OFF/ AUTO Switch (22 mm)	MANUAL/AUTO Ref Switch (22 mm)	START/STOP Pushbuttons (22 mm)	115 Volt Control Transformer 550 VA	Standard Elapsed Time Meter
	K1	K2	K3	K4	K5	K6	KB	KO
hp	Adder U.S. $	Adder U.S. $	Adder U.S. $	Adder U.S. $	Adder U.S. $	Adder U.S. $	Adder U.S. $	Adder U.S. $
3/4 – 100								

Table 40-134. 208V Light Options

Catalog Number Suffix ➡	Power On/Fault Pilot Lights (22 mm)	Green RUN Light (22 mm)	Green STOP Light (22 mm)	Red RUN Light (22 mm)	Red STOP Light (22 mm)	Power On Light (22 mm)	Misc Light (22 mm)
	L1	LA	LD	LE	LF	LJ	LU
hp	Adder U.S. $	Adder U.S. $	Adder U.S. $	Adder U.S. $	Adder U.S. $	Adder U.S. $	Adder U.S. $
3/4 – 100							

Table 40-135. 208V Bypass Options

Catalog Number Suffix ➡	Bypass Test Switch for RA, RB	Bypass Pilot Lights for RA, RB Options	Dual Overloads for Bypass	Manual HOA Bypass Controller	Manual IOB Bypass Controller	Auto Transfer HOA Bypass Controller	Auto Transfer IOB Bypass Controller
	KF	L2	PN	RA	RB	RC	RD
hp	Adder U.S. $	Adder U.S. $	Adder U.S. $	Adder U.S. $	Adder U.S. $	Adder U.S. $	Adder U.S. $
3/4 – 7-1/2							
10 15 20							
25 30 40							
50 60 75 100							

40

Discount Symbol **SS-3**

Table 40-136. 208V Enclosure Options

Catalog Number Suffix ➡	Floor Stand 22" (558.8 mm)	Floor Stand 12" (304.8 mm)	10" (254 mm) Expansion	20" (508 mm) Expansion	Space Heater ①
	S5	S6	S7	S8	S9
Enclosure Size	Adder U.S. $	Adder U.S. $	Adder U.S. $	Adder U.S. $	Adder U.S. $
0 1 2					
3 4 5					

① Requires customer supplied 115V AC supply.

Table 40-137. 208V Power Options

Catalog Number Suffix ➡	Input			Output				
	Input Disconnect (HMCP) 100 kAIC	Input Line Fuses 200 kAIC	Input Power Surge Protection	Output Contactor	Output Filter ②	MotoRx (300 – 600 Ft.) 1000 V/µS DV/DT Filter ②	Single Overload Relay	Dual Overload Relays
	P1	P3	P7	PE	PF	PG	PH	PI
hp	Adder U.S. $	Adder U.S. $	Adder U.S. $	Adder U.S. $	Adder U.S. $	Adder U.S. $	Adder U.S. $	Adder U.S. $
3/4 – 5								
7-1/2 10 15 20								
25 30 40								
50 60 75 100								

② Not required for 208V applications.

230V Drives

Table 40-138. 230V AC Input Base Drive

Enclosure Size ①	hp	Current (A)	NEMA Type 1			NEMA Type 12		
			Frame Size	Base Catalog Number ②	Price U.S. $ ②	Frame Size	Base Catalog Number ②	Price U.S. $ ②
230V High Overload Drive and Enclosure								
0	3/4	3.7	4	**SVXF0712EA**		4	**SVXF0722EA**	
0	1	4.8	4	**SVX00112EA**		4	**SVX00122EA**	
0	1-1/2	6.6	4	**SVXF1512EA**		4	**SVXF1522EA**	
0	2	7.8	4	**SVX00212EA**		4	**SVX00222EA**	
0	3	11	4	**SVX00312EA**		4	**SVX00322EA**	
0	5	17.5	5	**SVX00512EA**		5	**SVX00522EA**	
0	7-1/2	25	5	**SVX00712EA**		5	**SVX00722EA**	
1	10	31	6	**SVX01012EA**		6	**SVX01022EA**	
1	15	48	6	**SVX01512EA**		6	**SVX01522EA**	
2	20	61	7	**SVX02012DA**		7	**SVX02022DA**	
2	25	75	7	**SVX02512DA**		7	**SVX02522DA**	
2	30	88	7	**SVX03012DA**		7	**SVX03022DA**	
3	40	114	8	**SVX04012DA**		8	**SVX04022DA**	
4	50	140	8	**SVX05012DA**		8	**SVX05022DA**	
5	60	170	8	**SVX06012DA**		8	**SVX06022DA**	
5	75	205	9	**SVX07512DA**		9	**SVX07522DA**	
5	100	261	9	**SVX10012DA**		9	**SVX10022DA**	
230V Low Overload Drive and Enclosure								
0	1	4.8	4	**SVX00112BA**		4	**SVX00122BA**	
0	1-1/2	6.6	4	**SVXF1512BA**		4	**SVXF1522BA**	
0	2	7.8	4	**SVX00212BA**		4	**SVX00222BA**	
0	3	11	4	**SVX00312BA**		4	**SVX00322BA**	
0	5	17.5	5	**SVX00512BA**		5	**SVX00522BA**	
0	7-1/2	25	5	**SVX00712BA**		5	**SVX00722BA**	
0	10	31	5	**SVX01012BA**		5	**SVX01022BA**	
1	15	48	6	**SVX01512BA**		6	**SVX01522BA**	
1	20	61	6	**SVX02012BA**		6	**SVX02022BA**	
2	25	75	7	**SVX02512AA**		7	**SVX02522AA**	
2	30	88	7	**SVX03012AA**		7	**SVX03022AA**	
2	40	114	7	**SVX04012AA**		7	**SVX04022AA**	
3	50	140	8	**SVX05012AA**		8	**SVX05022AA**	
4	60	170	8	**SVX06012AA**		8	**SVX06022AA**	
5	75	205	8	**SVX07512AA**		8	**SVX07522AA**	
5	③	261 ③	9	**SVX10012AA**		9	**SVX10022AA**	

① Enclosure dimensions listed on **Pages 40-101 – 40-108.**
② Includes drive, Local/Remote Keypad and enclosure.
③ This unit is current rated (100 I_L hp 261 Amps). It is not hp rated.

Table 40-139. 230V Brake Chopper Adder ④

I_H hp	Adder U.S. $	I_L hp	Adder U.S. $
	NEMA Type 1/12		NEMA Type 1/12
3/4 1 1-1/2 2		— 1 1-1/2 2	
3 5 7-1/2 10		3 5 7-1/2 10	
15 20 25 30 40		15 20 25 30 40	
50 60 75 100		50 60 75 100	

④ External dynamic braking resistors not included. Consult factory.

Discount Symbol........................ SS-3

Table 40-140. 230V Control Options

Catalog Number Suffix ➡	Door-Mounted Speed Potentiometer	Door-Mounted Speed Potentiometer with HOA Selector Switch	3 – 15 psig Follower	HAND/OFF/ AUTO Switch (22 mm)	MANUAL/AUTO Ref Switch (22 mm)	START/STOP Pushbuttons (22 mm)	115 Volt Control Transformer 550 VA	Standard Elapsed Time Meter
	K1	K2	K3	K4	K5	K6	KB	KO
hp	Adder U.S. $	Adder U.S. $	Adder U.S. $	Adder U.S. $	Adder U.S. $	Adder U.S. $	Adder U.S. $	Adder U.S. $
3/4 – 100								

Table 40-141. 230V Light Options

Catalog Number Suffix ➡	Power On/Fault Pilot Lights (22 mm)	Green RUN Light (22 mm)	Green STOP Light (22 mm)	Red RUN Light (22 mm)	Red STOP Light (22 mm)	Power On Light (22 mm)	Misc Light (22 mm)
	L1	LA	LD	LE	LF	LJ	LU
hp	Adder U.S. $	Adder U.S. $	Adder U.S. $	Adder U.S. $	Adder U.S. $	Adder U.S. $	Adder U.S. $
3/4 – 100							

Table 40-142. 230V Bypass Options ①

Catalog Number Suffix ➡	Bypass Test Switch for RA, RB, RC, RD	Bypass Pilot Lights for RA, RB Options	Dual Overloads for Bypass	Manual HOA Bypass Controller	Manual IOB Bypass Controller	Auto Transfer HOA Bypass Controller	Auto Transfer IOB Bypass Controller
	KF	L2	PN	RA	RB	RC	RD
hp	Adder U.S. $	Adder U.S. $	Adder U.S. $	Adder U.S. $	Adder U.S. $	Adder U.S. $	Adder U.S. $
3/4 – 10							
15 20							
25 30 40							
50 60 75 100							

① See **Pages 40-88** and **40-89** for details.

Discount Symbol **SS-3**

Table 40-143. 230V Enclosure Options

Catalog Number Suffix ➡	Floor Stand 22" (558.8 mm)	Floor Stand 12" (304.8 mm)	10" (254 mm) Expansion	20" (508 mm) Expansion	Space Heater ①
	S5	S6	S7	S8	S9
Enclosure Size	Adder U.S. $	Adder U.S. $	Adder U.S. $	Adder U.S. $	Adder U.S. $
0 1 2					
3 4 5					

① Requires customer supplied 115V AC supply.

Table 40-144. 230V Power Options

Catalog Number Suffix ➡	Input			Output				
	Input Disconnect (HMCP) 100 kAIC	Input Line Fuses 200 kAIC	Input Power Surge Protection	Output Contactor	Output Filter ②	MotoRx (300 – 600 Ft.) 1000 V/µS DV/DT Filter	Single Overload Relay	Dual Overload Relays
	P1	P3	P7	PE	PF	PG	PH	PI
hp	Adder U.S. $	Adder U.S. $	Adder U.S. $	Adder U.S. $	Adder U.S. $	Adder U.S. $	Adder U.S. $	Adder U.S. $
3/4 – 5								
7-1/2 10 15 20								
25 30 40								
50 60 75 100								

② Not required for 230V applications.

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Discount Symbol SS-3

480V Drives

Table 40-145. 480V AC Input Base Drive

Enclosure Size ①	hp	Current (A)	NEMA Type 1 Frame Size	NEMA Type 1 Base Catalog Number ②	NEMA Type 1 Price U.S. $ ②	NEMA Type 12 Frame Size	NEMA Type 12 Base Catalog Number ②	NEMA Type 12 Price U.S. $ ②
High Overload Drive and Enclosure								
0	1	2.2	4	**SVX00114EA**		4	**SVX00124EA**	
0	1-1/2	3.3	4	**SVXF1514EA**		4	**SVXF1524EA**	
0	2	4.3	4	**SVX00214EA**		4	**SVX00224EA**	
0	3	5.6	4	**SVX00314EA**		4	**SVX00324EA**	
0	5	7.6	4	**SVX00514EA**		4	**SVX00524EA**	
0	7-1/2	12	5	**SVX00714EA**		5	**SVX00724EA**	
0	10	16	5	**SVX01014EA**		5	**SVX01024EA**	
0	15	23	5	**SVX01514EA**		5	**SVX01524EA**	
1	20	31	6	**SVX02014EA**		6	**SVX02024EA**	
1	25	38	6	**SVX02514EA**		6	**SVX02524EA**	
1	30	46	6	**SVX03014EA**		6	**SVX03024EA**	
2	40	61	7	**SVX04014DA**		7	**SVX04024DA**	
2	50	72	7	**SVX05014DA**		7	**SVX05024DA**	
2	60	87	7	**SVX06014DA**		7	**SVX06024DA**	
3	75	105	8	**SVX07514DA**		8	**SVX07524DA**	
3	100	140	8	**SVX10014DA**		8	**SVX10024DA**	
4	125	170	8	**SVX12514DA**		8	**SVX12524DA**	
5	150	205	9	**SVX15014DA**		9	**SVX15024DA**	
5	200	245	9	**SVX20014DA**		9	**SVX20024DA**	
6, 8 ④⑥	250	300	10	**SVX25014DA**		10	**SVX25064DA**	
6, 8 ④⑥	300	385	10	**SVX30014DA**		10	**SVX30064DA**	
6, 8 ④⑥	350	460	10	**SVX35014DA**		10	**SVX35064DA**	
8, 9 ⑤⑥	400	520	11	**SVX40014DA**		11	**SVX40064DA**	
8, 9 ⑤⑥	500	590	11	**SVX50014DA**		11	**SVX50064DA**	
8, 9 ⑤⑥	550	650	11	**SVX55014DA**		11	**SVX55064DA**	
③	600	730	12	**SVX60014DA**		12	**SVX60064DA**	
③	650	820	12	**SVX65014DA**		12	**SVX65064DA**	
③	700	920	12	**SVX70014DA**		12	**SVX70064DA**	
Low Overload Drive and Enclosure								
0	1-1/2	3.3	4	**SVXF1514BA**		4	**SVXF1524BA**	
0	2	4.3	4	**SVX00214BA**		4	**SVX00224BA**	
0	3	5.6	4	**SVX00314BA**		4	**SVX00324BA**	
0	5	7.6	4	**SVX00514BA**		4	**SVX00524BA**	
0	7-1/2	12	4	**SVX00714BA**		4	**SVX00724BA**	
0	10	16	5	**SVX01014BA**		5	**SVX01024BA**	
0	15	23	5	**SVX01514BA**		5	**SVX01524BA**	
0	20	31	5	**SVX02014BA**		5	**SVX02024BA**	
1	25	38	6	**SVX02514BA**		6	**SVX02524BA**	
1	30	46	6	**SVX03014BA**		6	**SVX03024BA**	
1	40	61	6	**SVX04014BA**		6	**SVX04024BA**	
2	50	72	7	**SVX05014AA**		7	**SVX05024AA**	
2	60	87	7	**SVX06014AA**		7	**SVX06024AA**	
2	75	105	7	**SVX07514AA**		7	**SVX07524AA**	
3	100	140	8	**SVX10014AA**		8	**SVX10024AA**	
4	125	170	8	**SVX12514AA**		8	**SVX12524AA**	
4	150	205	8	**SVX15014AA**		8	**SVX15024AA**	
5	200	261	9	**SVX20014AA**		9	**SVX20024AA**	
5	250	300	9	**SVX25014AA**		9	**SVX25024AA**	
6, 8 ④⑥	300	385	10	**SVX30014AA**		10	**SVX30064AA**	
6, 8 ④⑥	350	460	10	**SVX35014AA**		10	**SVX35064AA**	
6, 8 ④⑥	400	520	10	**SVX40014AA**		10	**SVX40064AA**	
8, 9 ⑤⑥	500	590	11	**SVX50014AA**		11	**SVX50064AA**	
8, 9 ⑤⑥	550	650	11	**SVX55014AA**		11	**SVX55064AA**	
8, 9 ⑤⑥	600	730	11	**SVX60014AA**		11	**SVX60064AA**	
③	650	820	12	**SVX65014AA**		12	**SVX65064AA**	
③	700	920	12	**SVX70014AA**		12	**SVX70064AA**	
③	800	1030	12	**SVX80014AA**		12	**SVX80064AA**	

① Enclosure dimensions listed on **Pages 40-101 – 40-111.**
② Includes drive, Local/Remote keypad and enclosure.
③ Consult Eaton.
④ The smaller Enclosure Size 6 accommodates only power options, Input Disconnect (P1) and Input Line Fuses (P3). Bypass and other options require Size 8. Adding any standard control option will not require the larger enclosure.
⑤ The smaller Enclosure Size 8 accommodates only power options, Input Disconnect (P1) and Input Line Fuses (P3). Bypass and other options require Size 9. Adding any standard control option will not require the larger enclosure.
⑥ For other options, consult factory.

Table 40-146. 480V Brake Chopper Adder ⑦

I_H hp	Adder U.S. $ NEMA Type 1/12	I_L hp	Adder U.S. $ NEMA Type 1/12
1		—	
1-1/2		1-1/2	
2		2	
3		3	
5		5	
7-1/2		7-1/2	
10		10	
15		15	
20		20	
25		25	
30		30	
40		40	
50		50	
60		60	
75		75	
100		100	
125		125	
150		150	
200		200	
250		250	
300		300	
350		350	
400		400	
500		500	
550		550	
600		600	
650		650	
700		700	
		800	

⑦ External dynamic braking resistors not included. Consult factory.

Discount Symbol **SS-3**

Table 40-147. 480V Light Options

Catalog Number Suffix ➡	Power On/Fault Pilot Lights (22 mm)	Green RUN Light (22 mm)	Green STOP Light (22 mm)	Red RUN Light (22 mm)	Red STOP Light (22 mm)	Power On Light (22 mm)	Misc Light (22 mm)
	L1	LA	LD	LE	LF	LJ	LU
hp	Adder U.S. $	Adder U.S. $	Adder U.S. $	Adder U.S. $	Adder U.S. $	Adder U.S. $	Adder U.S. $
1 – 800							

Table 40-148. 480V Control Options

Catalog Number Suffix ➡	Door-Mounted Speed Potentiometer	Door-Mounted Speed Potentiometer with HOA Selector Switch	3 – 15 psig Follower	HAND/OFF/ AUTO Switch (22 mm)	MANUAL/AUTO Ref Switch (22 mm)	START/STOP Pushbuttons (22 mm)	115 Volt Control Transformer 550 VA	Standard Elapsed Time Meter
	K1	K2	K3	K4	K5	K6	KB	KO
hp	Adder U.S. $	Adder U.S. $	Adder U.S. $	Adder U.S. $	Adder U.S. $	Adder U.S. $	Adder U.S. $	Adder U.S. $
1 – 800								

Table 40-149. 480V Bypass Options ①

Catalog Number Suffix ➡	Bypass Test Switch for RA, RB, RC, RD	Bypass Pilot Lights for RA, RB Options	Dual Overloads for Bypass	Manual HOA Bypass Controller	Manual IOB Bypass Controller	Auto Transfer HOA Bypass Controller	Auto Transfer IOB Bypass Controller
	KF	L2	PN	RA	RB	RC	RD
hp	Adder U.S. $	Adder U.S. $	Adder U.S. $	Adder U.S. $	Adder U.S. $	Adder U.S. $	Adder U.S. $
1 – 20							
25							
30 40 50 60 75							
100 125 150 200 250							
300 350 400 500 550							
600 650 700 800							

① See **Pages 40-88** and **40-89** for details.

Table 40-150. 480V Enclosure Options

Catalog Number Suffix ➡	Floor Stand 22" (558.8 mm)	Floor Stand 12" (304.8 mm)	10" (254 mm) Expansion ③	20" (508 mm) Expansion ④	Space Heater ②
	S5	S6	S7	S8	S9
Enclosure Size	Adder U.S. $	Adder U.S. $	Adder U.S. $	Adder U.S. $	Adder U.S. $
0 1 2 3					
4 5					
6 8 9					

② Requires customer supplied 115V AC supply.
③ See Enclosure 5-1P on **Page 40-107** for dimensions.
④ See Enclosure 5-2P on **Page 40-108** for dimensions.

Discount Symbol **SS-3**

Enclosed Drives

Table 40-151. 480V Power Options

Catalog Number Suffix	Input			Output				
	Input Disconnect (HMCP) 100 kAIC	Input Line Fuses 200 kAIC	Input Power Surge Protection	Output Contactor	Output Filter ①	MotoRx (300 – 600 Ft.) 1000 V/µS DV/DT Filter ①	Single Overload Relay ②	Dual Overload Relays ②
	P1	P3	P7	PE	PF	PG	PH	PI
hp	Adder U.S. $	Adder U.S. $	Adder U.S. $	Adder U.S. $	Adder U.S. $	Adder U.S. $	Adder U.S. $	Adder U.S. $
1 – 2								
3 – 5								
7-1/2 10 15 20 25								
30 40 50 60 75								
100 125 150 200 250								
300 350 400 500 550								
600 650 700 800								

① Output filter may be required whenever the distance from the drive to the motor exceeds 100 feet (30m). Refer to Application Notes for further details.
② Heater packs not included.

Table 40-152. Input Options

Catalog Number Suffix	Load Switch
	P2 ③
hp	Adder U.S. $
250 300 350	
400 500 550	

③ Applicable with FR10 and FR11 Freestanding designs only.

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Discount Symbol SS-3

Dimensions

Enclosure Size 0

Table 40-153. Approximate Dimensions and Shipping Weight — Enclosed Products

Enclosure Size	Dimensions in Inches (mm)												
	Wide A	High B	Deep C	Mounting							H	Min. Air Space	
				D	D1	E	E1	F	G	G1		J	K
0	19.9 (504)	29.0 (737)	16.4 (416)	18.3 (465)	—	—	—	27.4 (695)	—	—	25.4 (644)	4.0 (102)	3.0 (76)

Table 40-153. Approximate Dimensions and Shipping Weight — Enclosed Products (Continued)

Enclosure Size	Dimensions in Inches (mm)										Max. Approx. Ship. Wt. lbs. (kg)
	Cable Entry					Door Clearance S	T	U	V	W	
	L	M	N	P	R						
0	5.0 (127)	—	—	6.0 (152)	9.6 (245)	26.4 (669)	1.5 (38)	6.3 (160)	4.3 (108)	5.3 (134)	200 (91)

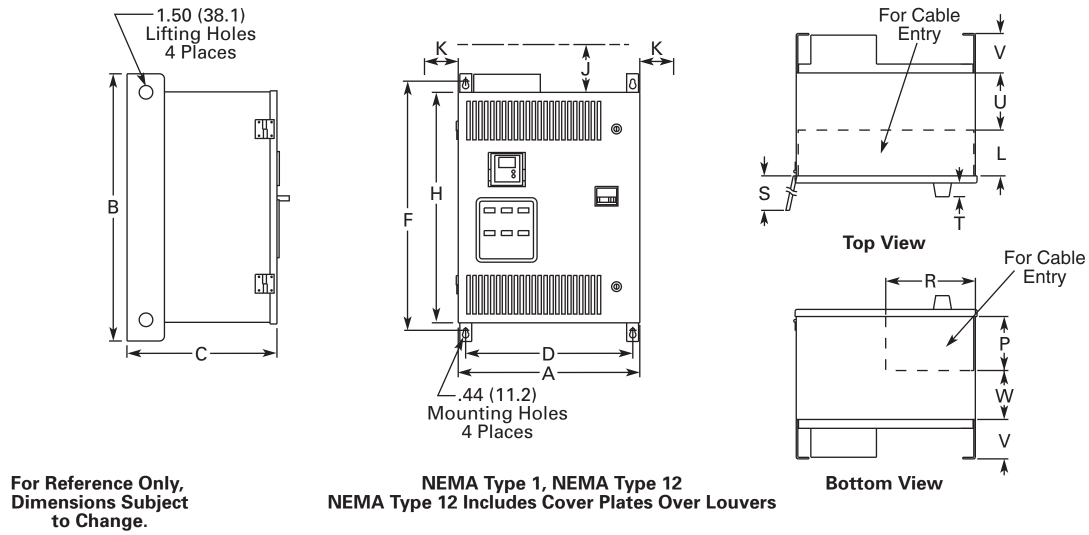


Figure 40-42. Approximate Dimensions

Enclosure Size 1

Table 40-154. Approximate Dimensions and Shipping Weight — Enclosed Products

Enclosure Size	Dimensions in Inches (mm)												
	Wide A	High B	Deep C	Mounting							H	Min. Air Space	
				D	D1	E	E1	F	G	G1		J	K
1	26.4 (669)	36 (914)	16.3 (414)	24.8 (630)	—	—	—	34.0 (864)	—	—	32.4 (822)	4.0 (102)	3.0 (76)

Table 40-154. Approximate Dimensions and Shipping Weight — Enclosed Products (Continued)

Enclosure Size	Dimensions in Inches (mm)															
	Cable Entry					Door Clearance S	T	U	V	W	Floor Stand					
	L	M	N	P	R						X	Y	Z	AA	BB	CC
1	11.0 (279)	6.0 (152)	9.0 (229)	10.0 (254)	6.5 (165)	26.4 (669)	1.5 (38)	4.3 (108)	—	—	56.0 (1422)	4.3 (108)	11.1 (281)	1.8 (46)	0.8 (19)	55.2 (1402)

Table 40-154. Approximate Dimensions and Shipping Weight — Enclosed Products (Continued)

Enclosure Size	Dimensions in Inches (mm)																Max. Approx. Ship. Wt. lbs. (kg)
	Floor Stand											RR	SS	TT	UU	VV	
	DD	EE	FF	GG	HH	JJ	KK	LL	MM	NN	PP						
1	26.0 (660)	3.5 (90)	5.5 (141)	3.0 (76)	6.0 (152)	2.0 (51)	5.4 (136)	1.1 (28)	8.8 (224)	5.4 (137)	—	—	—	—	—	—	230 (104)

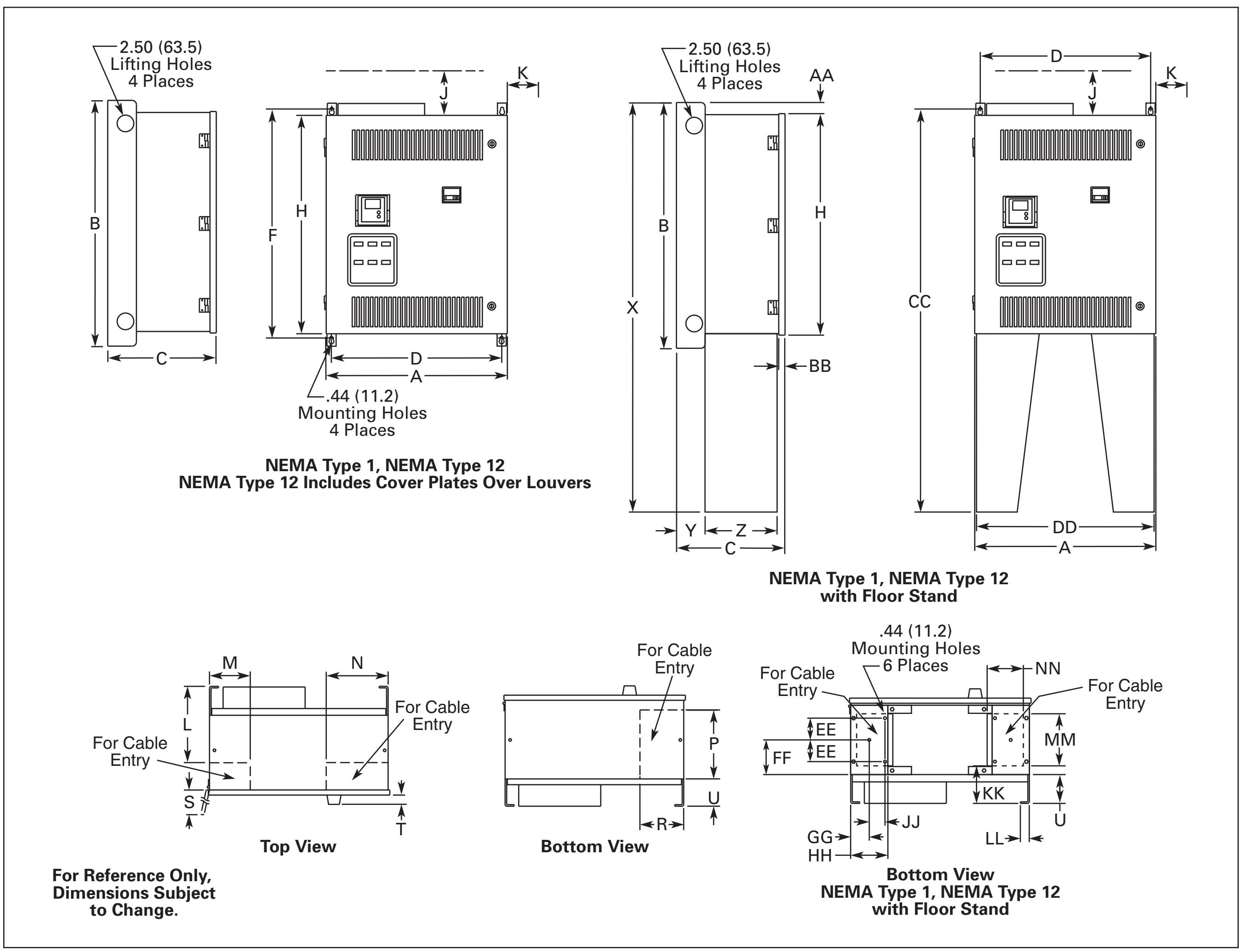


Figure 40-43. Approximate Dimensions

Enclosure Size 2

Table 40-155. Approximate Dimensions and Shipping Weight — Enclosed Products

Enclosure Size	Dimensions in Inches (mm)												
	Wide	High	Deep	Mounting							H	Min. Air Space	
	A	B	C	D	D1	E	E1	F	G	G1		J	K
2	26.4 (669)	59.0 (1499)	19.4 (492)	24.8 (630)	—	—	—	57.0 (1448)	—	—	55.4 (1406)	4.0 (102)	3.0 (76)

Table 40-155. Approximate Dimensions and Shipping Weight — Enclosed Products (Continued)

Enclosure Size	Dimensions in Inches (mm)														
	Cable Entry					Door Clearance	T	U	V	W	Floor Stand				
	L	M	N	P	R	S					X	Y	Z	AA	BB	CC
2	5.9 (149)	—	—	12.4 (315)	9.5 (241)	26.4 (669)	1.5 (38)	4.8 (121)	5.9 (151)	—	69.0 (1753)	4.8 (121)	13.6 (344)	1.8 (46)	.8 (19)	68.2 (1732)

Table 40-155. Approximate Dimensions and Shipping Weight — Enclosed Products (Continued)

Enclosure Size	Dimensions in Inches (mm)																Max. Approx. Ship. Wt. lbs. (kg)
	Floor Stand											RR	SS	TT	UU	VV	
	DD	EE	FF	GG	HH	JJ	KK	LL	MM	NN	PP						
2	26.0 (660)	4.8 (121)	6.8 (172)	3.0 (76)	6.0 (152)	2.0 (51)	5.0 (127)	1.1 (28)	11.3 (288)	79.0 (2007)	78.2 (1986)	—	—	—	—	—	380 (173)

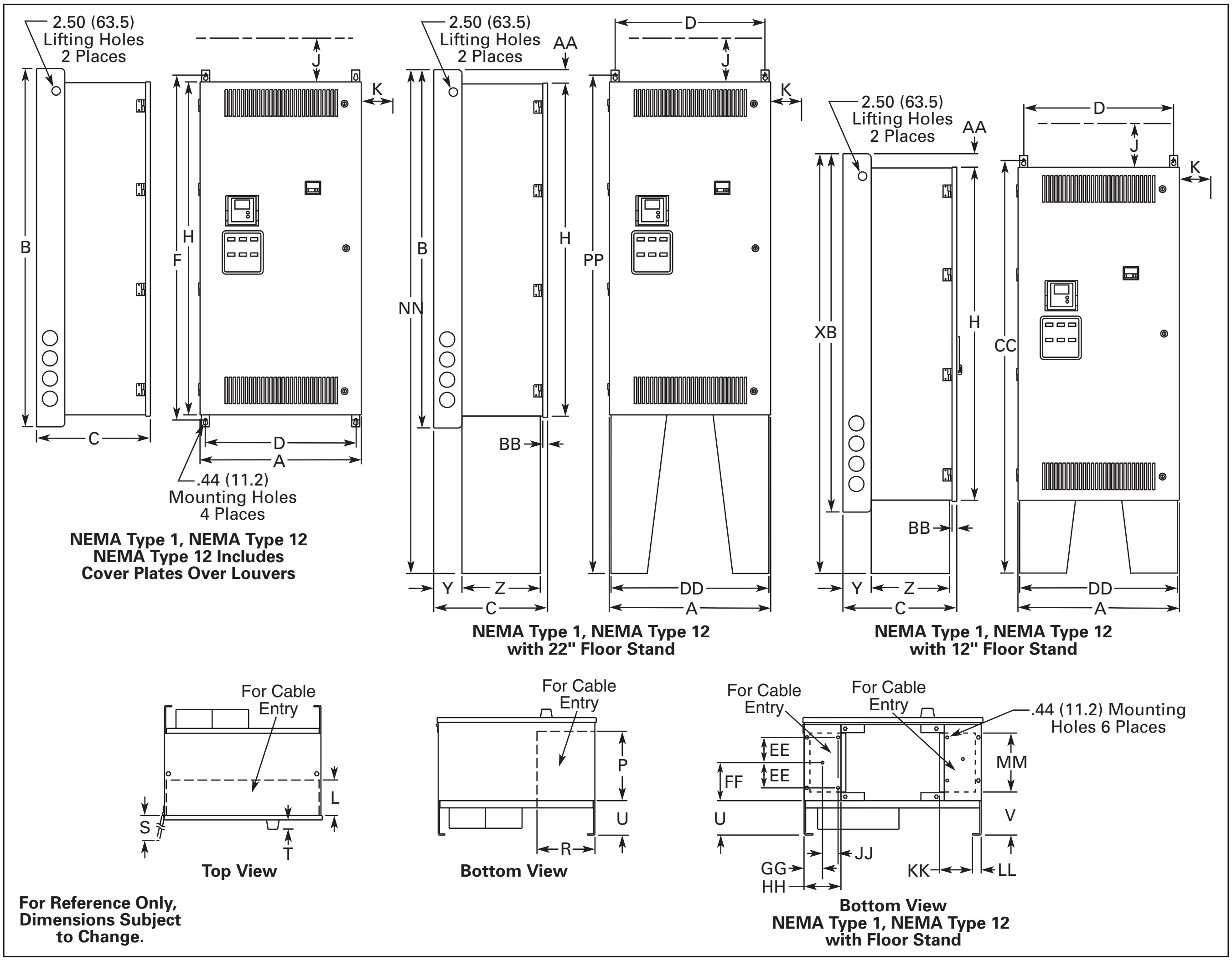


Figure 40-44. Approximate Dimensions

Enclosure Size 3

Table 40-156. Approximate Dimensions and Shipping Weight — Enclosed Products

Enclosure Size	Dimensions in Inches (mm)											
	Wide A	High B	Deep C	Mounting						H	Min. Air Space	
				D	D1	E	E1	F	G	G1		J	K
3	26.4 (671)	77.0 (1956)	19.4 (493)	19.5 (495)	3.3 (83)	23.0 (584)	1.5 (38)	11.7 (298)	5.5 (140.)	.9 (24)	76.4 (1939)	4.0 (102)	3.0 (76)

Table 40-156. Approximate Dimensions and Shipping Weight — Enclosed Products (Continued)

Enclosure Size	Dimensions in Inches (mm)															Max. Approx. Ship. Wt. lbs. (kg)
	Cable Entry					Door Clearance S	T	U	V	W	RR	SS	TT	UU	VV	
	L	M	N	P	R											
3	5.3 (133)	23.4 (594)	10.0 (254)	1.3 (32)	12.9 (328)	26.4 (669)	1.5 (38)	8.0 (203)	4.8 (121)	6.8 (173)	79.5 (2018)	13.4 (340)	.8 (19)	1.3 (32)	26.0 (660)	690 (313)

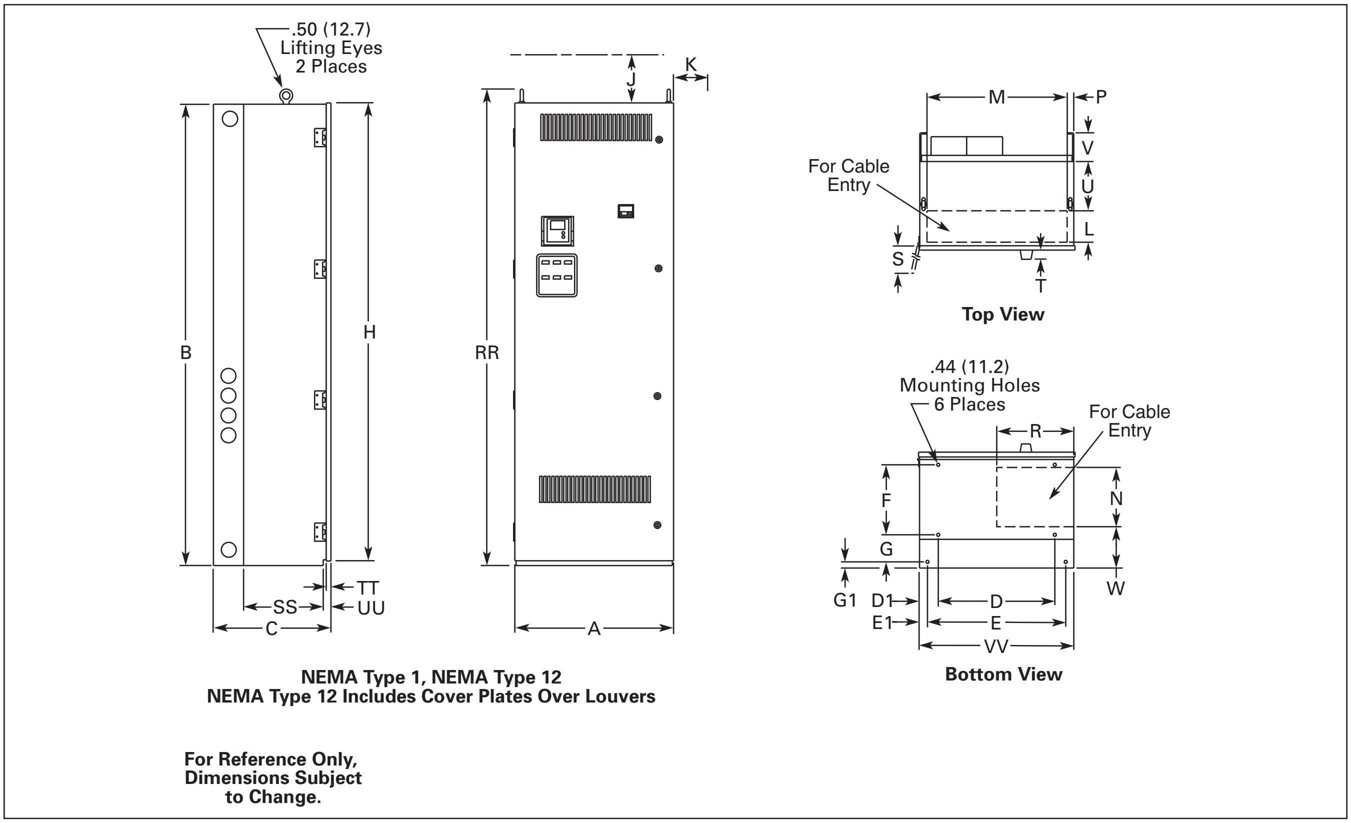


Figure 40-45. Approximate Dimensions

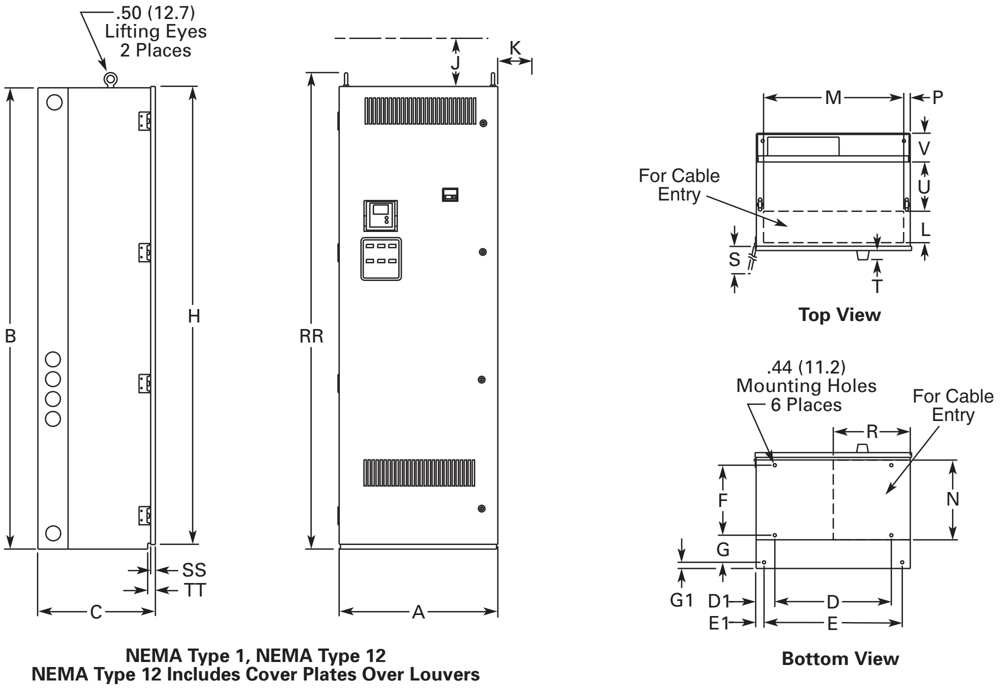
Enclosure Size 4

Table 40-157. Approximate Dimensions and Shipping Weight — Enclosed Products

Enclosure Size	Dimensions in Inches (mm)												
	Wide	High	Deep	Mounting							H	Min. Air Space	
	A	B	C	D	D1	E	E1	F	G	G1		J	K
4	26.4 (671)	90.0 (2286)	19.4 (493)	19.5 (495)	3.3 (83)	23.0 (584)	1.5 (38)	11.7 (298)	5.5 (140)	.9 (24)	89.4 (2270)	4.0 (102)	3.0 (76)

Table 40-157. Approximate Dimensions and Shipping Weight — Enclosed Products (Continued)

Enclosure Size	Dimensions in Inches (mm)															Max. Approx. Ship. Wt. lbs. (kg)
	Cable Entry					Door Clearance	T	U	V	W	RR	SS	TT	UU	VV	
	L	M	N	P	R	S										
4	5.3 (133)	23.4 (594)	13.8 (351)	1.0 (25)	11.2 (286)	26.4 (669)	1.5 (38)	8.0 (204)	4.8 (121)	—	92.5 (2349)	.8 (19)	1.3 (32)	—	—	825 (375)



NEMA Type 1, NEMA Type 12
NEMA Type 12 Includes Cover Plates Over Louvers

For Reference Only, Dimensions Subject to Change.

Figure 40-46. Approximate Dimensions

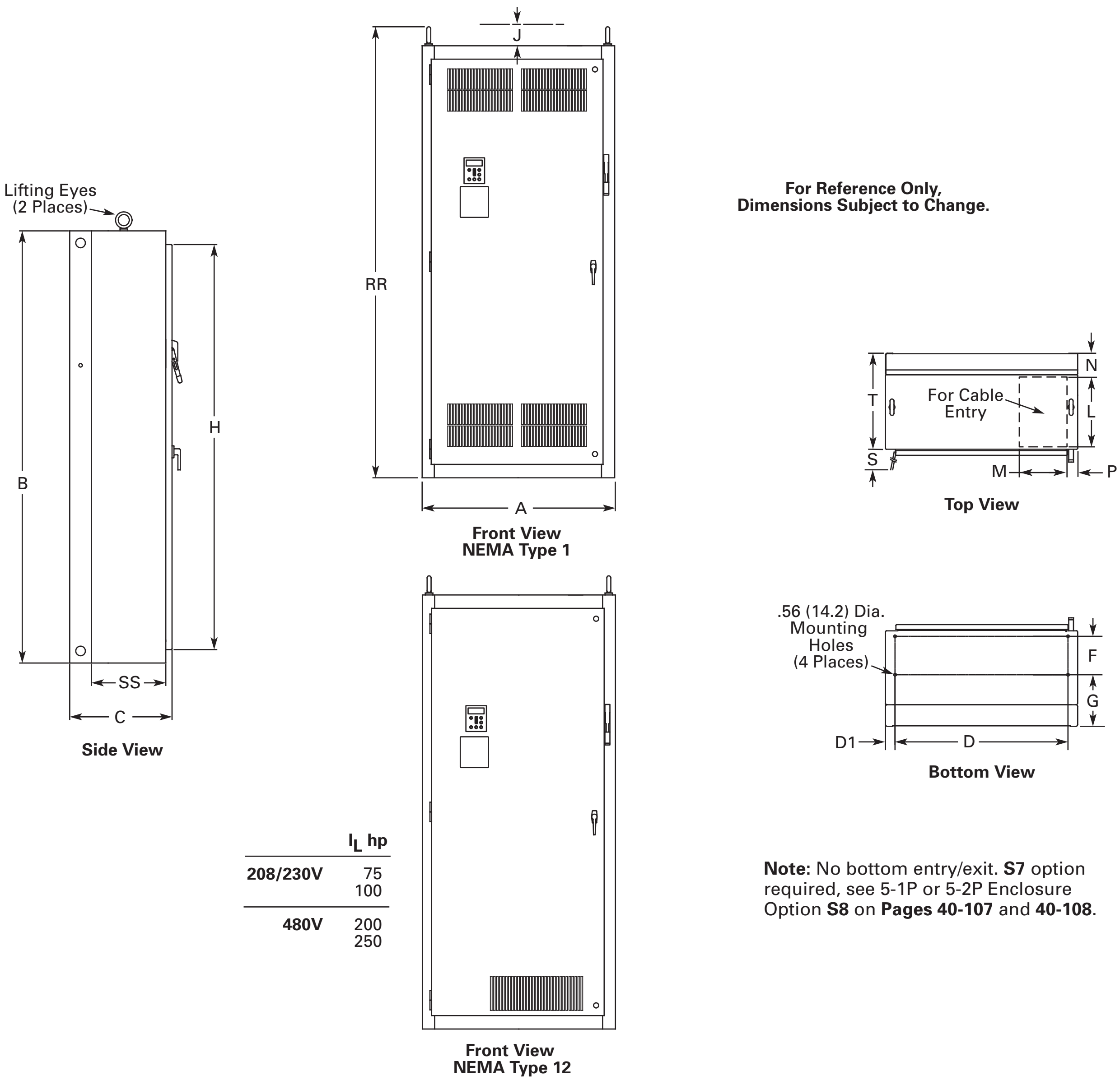
Enclosure Size 5

Table 40-158. Approximate Dimensions and Shipping Weight — Enclosed Products

Enclosure Size	Dimensions in Inches (mm)												
	Wide	High	Deep	Mounting							H	Min. Air Space	
	A	B	C	D	D1	E	E1	F	G	G1		J	K
5	40.0 (1016)	90.0 (2286)	21.3 (541)	36.0 (914)	2.0 (51)	—	—	8.0 (203)	10.8 (273)	—	84.4 (2143)	4.0 (102)	—

Table 40-158. Approximate Dimensions and Shipping Weight — Enclosed Products (Continued)

Enclosure Size	Dimensions in Inches (mm)															Max. Approx. Ship. Wt. lbs. (kg)
	Cable Entry					Door Clearance	T	U	V	W	RR	SS	TT	UU	VV	
	L	M	N	P	R	S										
5	15.0 (381)	10.0 (254)	4.8 (122)	2.0 (51)	—	36.3 (921)	20.0 (508)	—	—	—	94.0 (2387)	15.5 (394)	—	—	—	1275 (579)



	I_L hp
208/230V	75 100
480V	200 250

Note: No bottom entry/exit. **S7** option required, see 5-1P or 5-2P Enclosure Option **S8** on **Pages 40-107** and **40-108**.

Figure 40-47. Approximate Dimensions

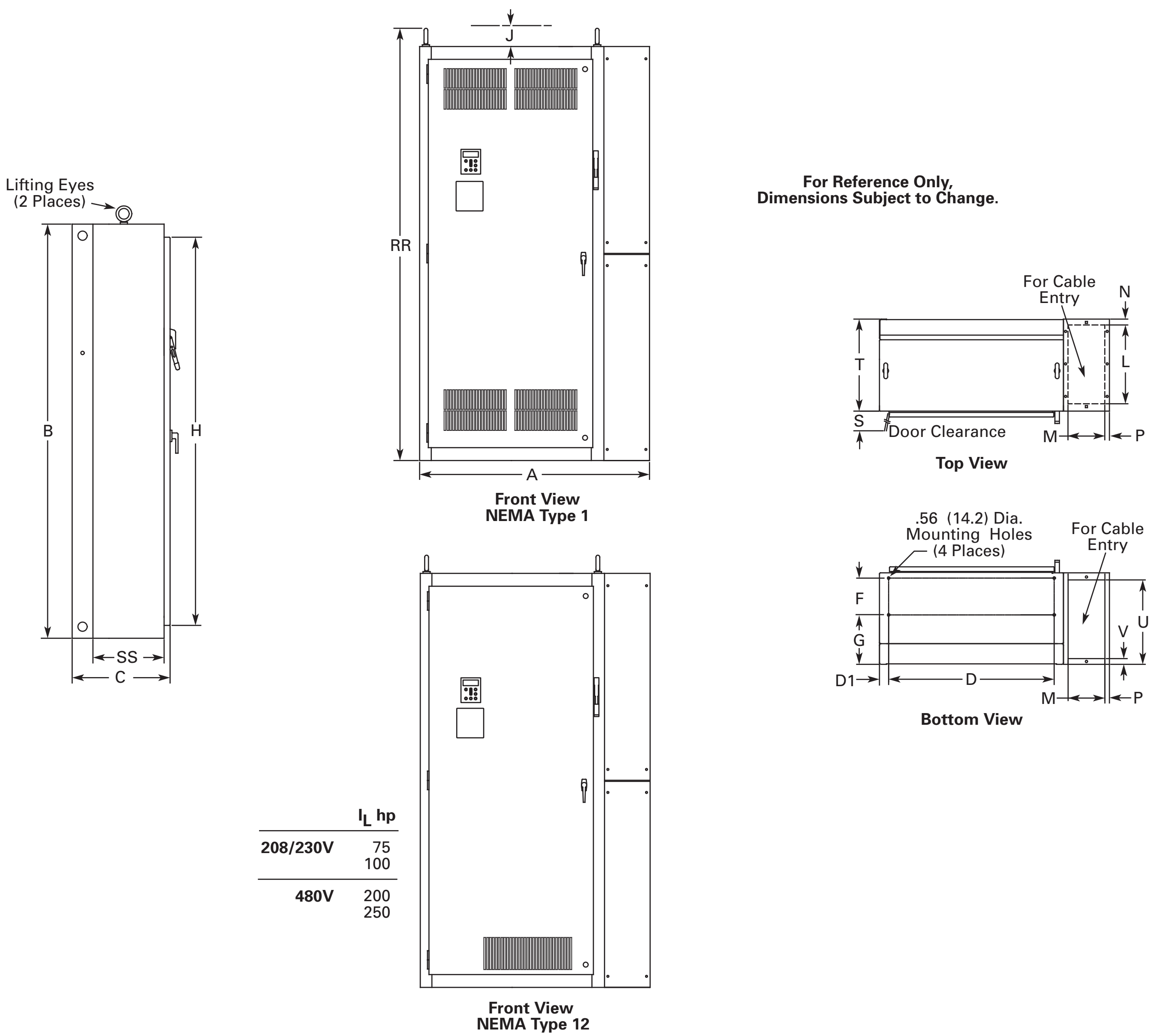
Enclosure Size 5-1P

Table 40-159. Approximate Dimensions and Shipping Weight — Enclosed Products

Enclosure Size	Dimensions in Inches (mm)												
	Wide	High	Deep	Mounting							H	Min. Air Space	
	A	B	C	D	D1	E	E1	F	G	G1		J	K
5-1P	50.0 (1270)	90.0 (2286)	21.3 (541)	36.0 (914)	2.0 (51)	—	—	8.0 (203)	10.8 (273)	—	84.4 (2143)	4.0 (102)	—

Table 40-159. Approximate Dimensions and Shipping Weight — Enclosed Products (Continued)

Enclosure Size	Dimensions in Inches (mm)															Max. Approx. Ship. Wt. lbs. (kg)
	Cable Entry					Door Clearance	T	U	V	W	RR	SS	TT	UU	VV	
	L	M	N	P	R	S										
5-1P	17.1 (435)	8.0 (203)	1.3 (33)	1.0 (25)	—	36.3 (921)	20.0 (508)	18.4 (466)	1.3 (32)	—	94.0 (2387)	15.5 (394)	—	—	—	1375 (624)



	I_L hp
208/230V	75 100
480V	200 250

Figure 40-48. Approximate Dimensions

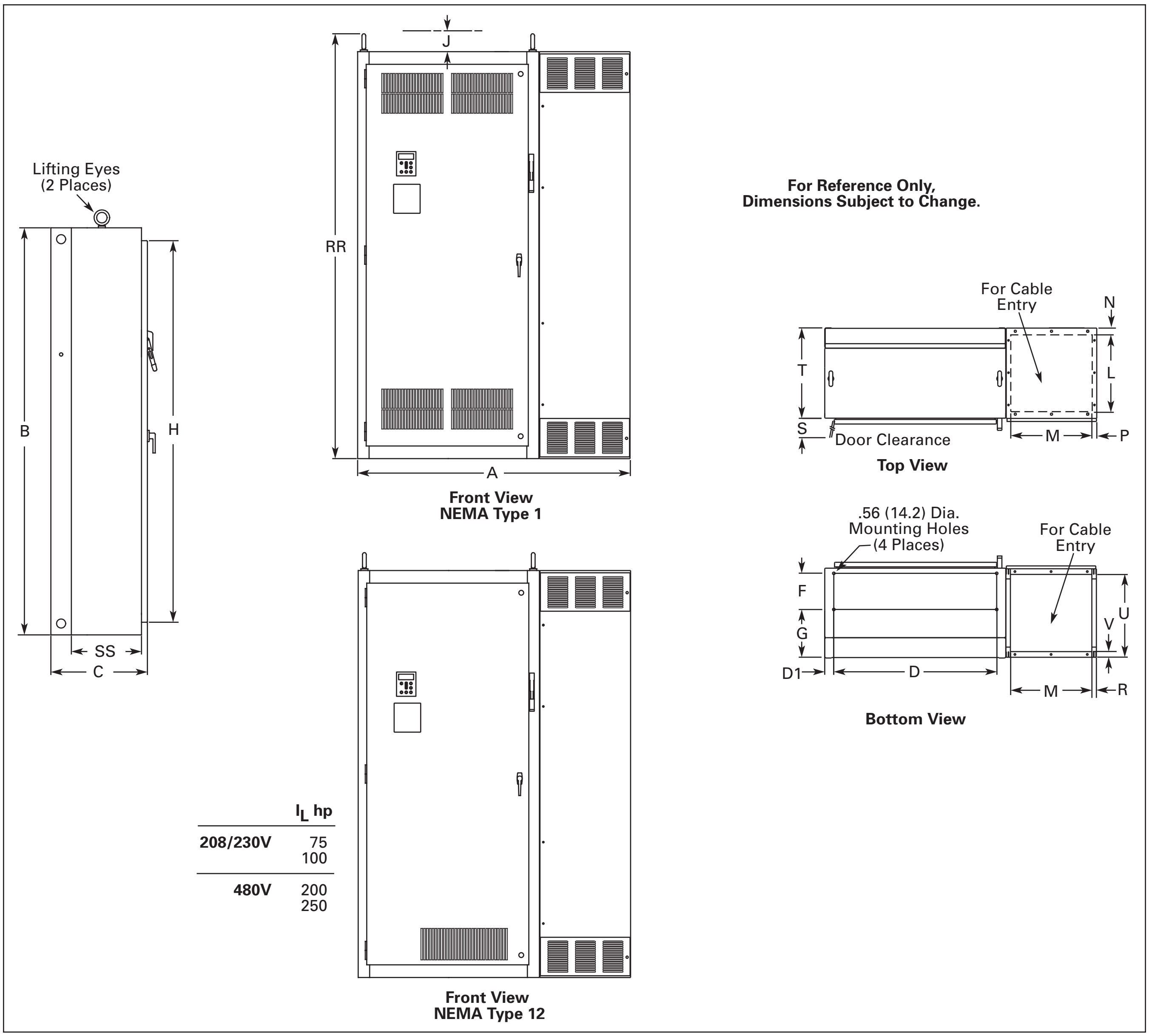
Enclosure Size 5-2P

Table 40-160. Approximate Dimensions and Shipping Weight — Enclosed Products

Enclosure Size	Dimensions in Inches (mm)												
	Wide	High	Deep	Mounting							H	Min. Air Space	
	A	B	C	D	D1	E	E1	F	G	G1		J	K
5-2P	60.0 (1524)	90.0 (2286)	21.3 (541)	36.0 (914)	2.0 (51)	—	—	8.0 (203)	10.8 (273)	—	84.4 (2143)	4.0 (102)	—

Table 40-160. Approximate Dimensions and Shipping Weight — Enclosed Products (Continued)

Enclosure Size	Dimensions in Inches (mm)															Max. Approx. Ship. Wt. lbs. (kg)
	Cable Entry					Door Clearance	T	U	V	W	RR	SS	TT	UU	VV	
	L	M	N	P	R	S										
5-2P	17.0 (432)	18.0 (457)	1.5 (38)	1.0 (25)	.9 (23)	36.3 (921)	20.0 (508)	18.4 (466)	1.3 (32)	—	94.0 (2387)	15.5 (394)	—	—	—	1585 (720)



	I_L hp
208/230V	75 100
480V	200 250

Figure 40-49. Approximate Dimensions

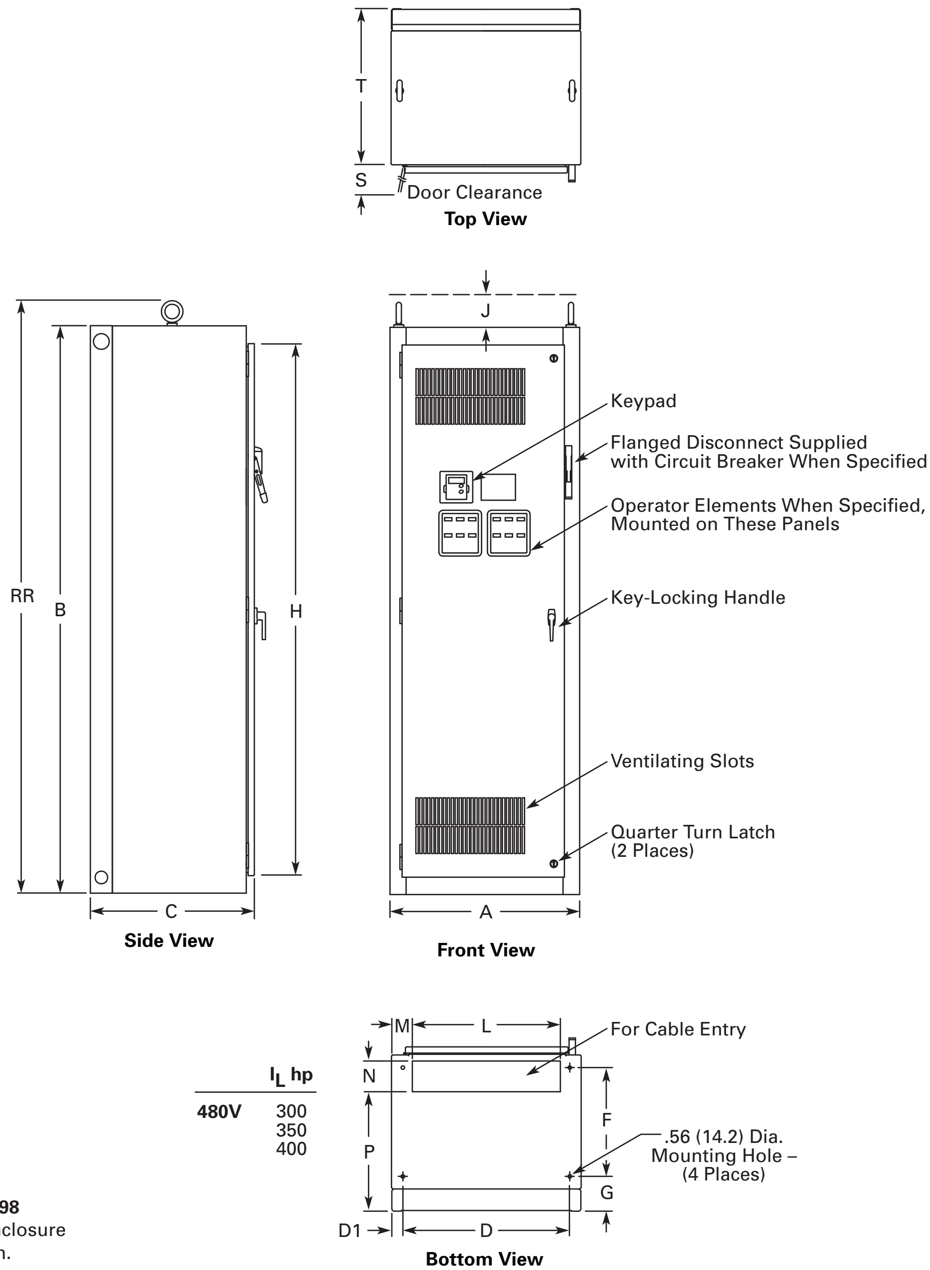
Enclosure Size 6

Table 40-161. Approximate Dimensions and Shipping Weight — Enclosed Products

Enclosure Size	Dimensions in Inches (mm)												
	Wide	High	Deep	Mounting							H	Min. Air Space	
	A	B	C	D	D1	D2	E	F	G	G1		J	K
6	30.0 (762)	90.0 (2286)	26.0 (660)	26.5 (673)	1.8 (46)	—	—	17.3 (438)	5.5 (140)	—	84.4 (2143)	4.0 (102)	—

Table 40-161. Approximate Dimensions and Shipping Weight — Enclosed Products (Continued)

Enclosure Size	Dimensions in Inches (mm)															Max. Approx. Ship. Wt. lbs. (kg)
	Cable Entry					Door Clearance	T	U	V	W	RR	SS	TT	UU	VV	
	L	M	N	P	R	S										
6	23.5 (597)	3.3 (84)	4.5 (114)	19.3 (490)	—	26.2 (667)	24.8 (629)	—	—	—	93.9 (2386)	—	—	—	—	1500 (681)



	I_L hp
480V	300
	350
	400

Note: See **Page 40-98** notes 4 and 5 for enclosure and option selection.

Figure 40-50. Approximate Dimensions

40

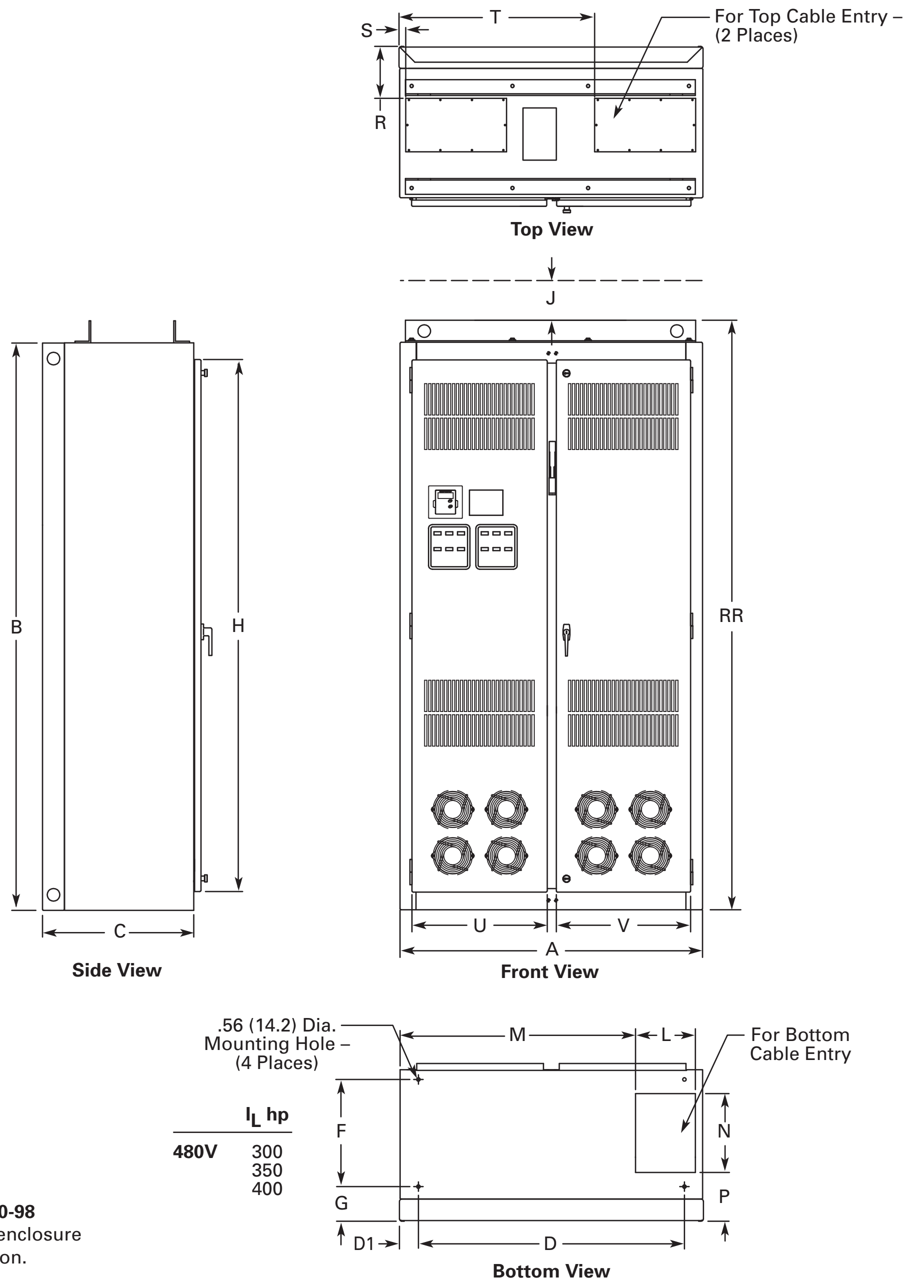
Enclosure Size 8

Table 40-162. Approximate Dimensions and Shipping Weight — Enclosed Products

Enclosure Size	Dimensions in Inches (mm)												
	Wide	High	Deep	Mounting							H	Min. Air Space	
	A	B	C	D	D1	D2	E	F	G	G1		J	K
8	48.0 (1219)	90.0 (2286)	24.0 (610)	42.2 (1072)	3.0 (77)	—	—	—	5.5 (139)	—	84.4 (2143)	4.0 (102)	—

Table 40-162. Approximate Dimensions and Shipping Weight — Enclosed Products (Continued)

Enclosure Size	Dimensions in Inches (mm)															Max. Approx. Ship. Wt. lbs. (kg)
	Cable Entry							U	V	W	RR	SS	TT	UU	VV	
	L	M	N	P	R	S	T									
8	9.5 (241)	37.5 (952)	12.5 (318)	7.7 (196)	8.3 (210)	1.3 (32)	31.0 (787)	21.5 (545)	21.3 (541)	—	93.5 (2375)	—	—	—	—	2000 (908)



Note: See **Page 40-98** notes 4 and 5 for enclosure and option selection.

Figure 40-51. Approximate Dimensions

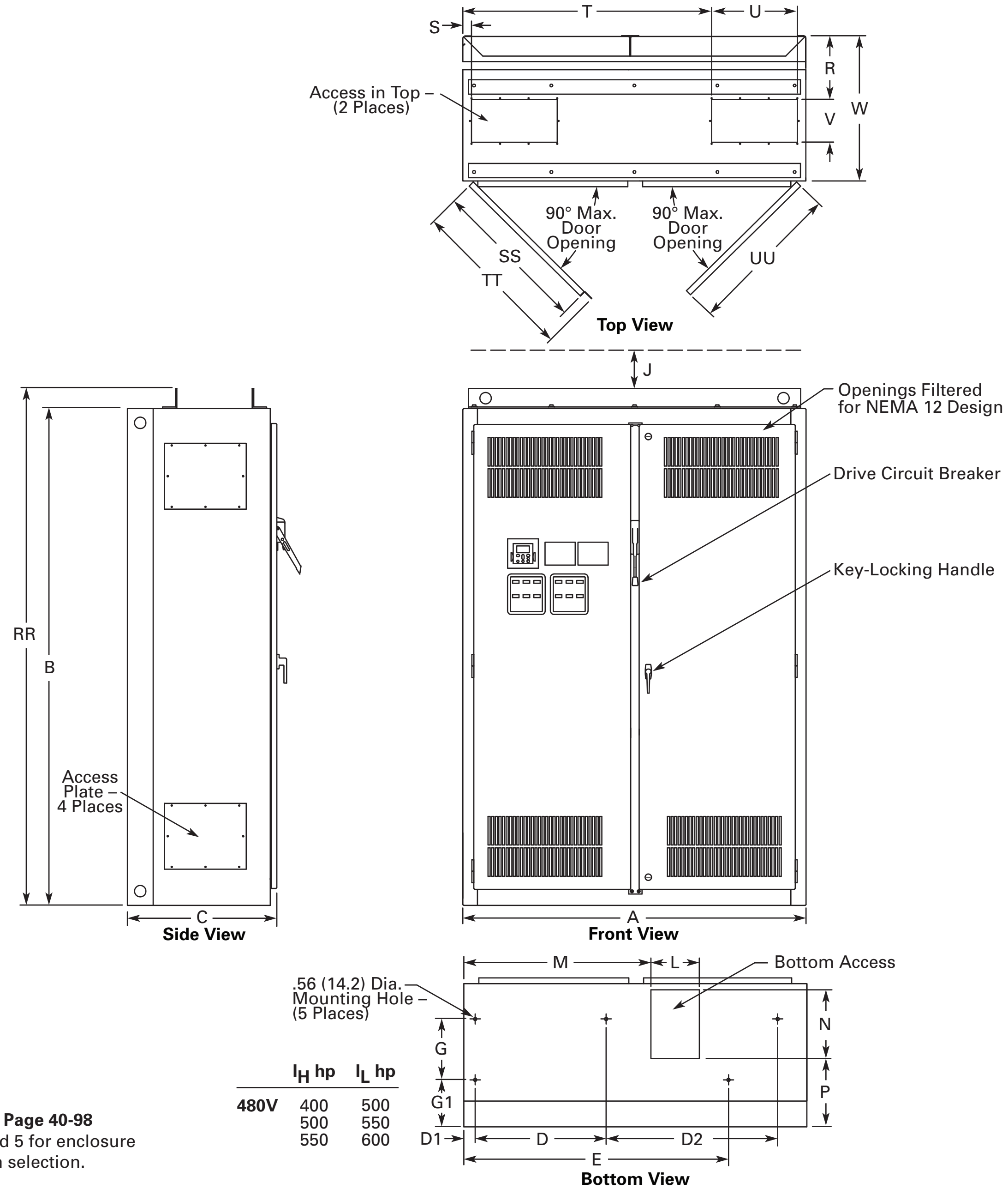
Enclosure Size 9

Table 40-163. Approximate Dimensions and Shipping Weight — Enclosed Products

Enclosure Size	Dimensions in Inches (mm)												
	Wide	High	Deep	Mounting							H	Min. Air Space	
	A	B	C	D	D1	D2	E	F	G	G1		J	K
9	60.0 (1524)	90.0 (2286)	26.1 (664)	22.9 (582)	2.0 (51)	30.0 (762)	44.3 (1125)	10.6 (270)	10.6 (270)	8.2 (208)	—	4.0 (102)	—

Table 40-163. Approximate Dimensions and Shipping Weight — Enclosed Products (Continued)

Enclosure Size	Dimensions in Inches (mm)															Max. Approx. Ship. Wt. lbs. (kg)
	Cable Entry									W	RR	SS	TT	UU	VV	
	L	M	N	P	R	S	T	U	V							
9	8.5 (216)	32.7 (831)	12.0 (305)	11.9 (303)	9.8 (249)	1.5 (38)	43.5 (1105)	15.0 (381)	7.5 (191)	25.0 (635)	93.5 (2375)	27.4 (696)	29.1 (738)	27.1 (687)	—	2500 (1135)

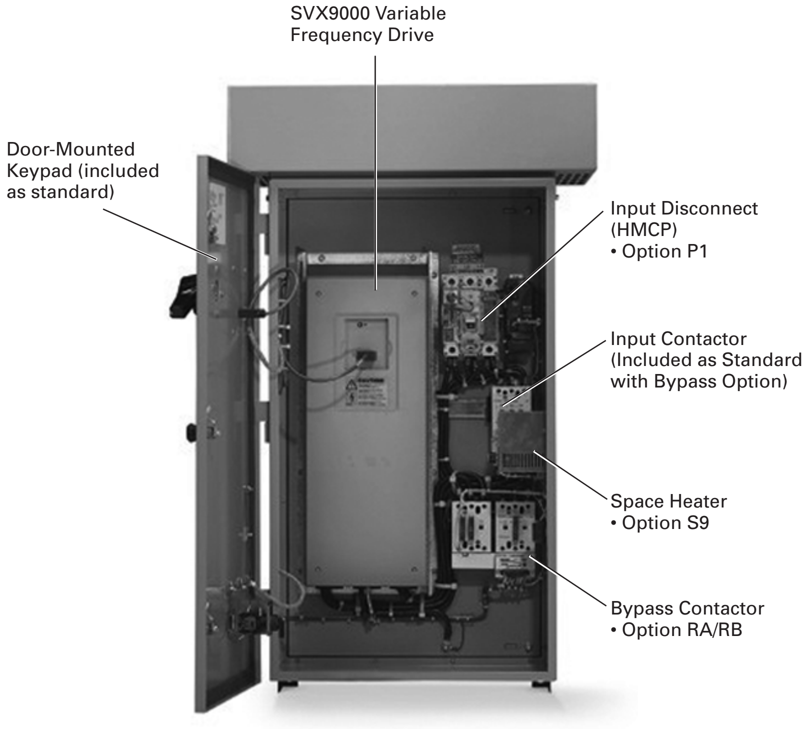


	I_H hp	I_L hp
480V	400	500
	500	550
	550	600

Note: See **Page 40-98** notes 4 and 5 for enclosure and option selection.

Figure 40-52. Approximate Dimensions

SVX9000 Pump Application



NEMA 3R Enclosed 9000X Series Drive

Standards and Certifications

- UL Listed
- cUL Listed

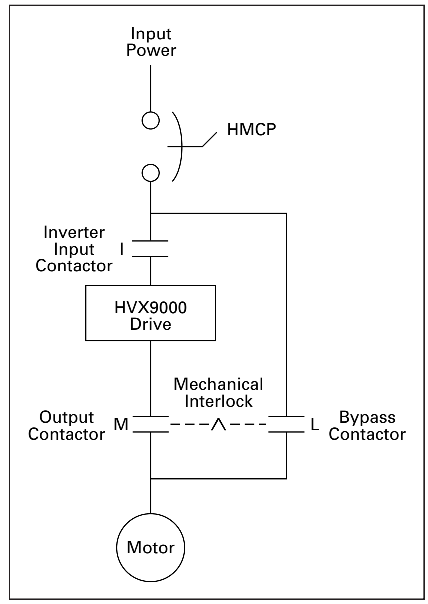


Figure 40-53. Power Diagram for Bypass Option RA

Product Description

- **Standard Enclosed** — covers a wide range of the most commonly ordered options. Pre-engineering eliminates the lead time normally associated with customer specific options.
- **Modified Standard Enclosed** — applies to specific customer requirements that vary from the Standard Enclosed offering, such as the need for an additional indicating light or minor modifications to drawings. *Consult your Eaton representative for assistance in pricing and lead time.*
- **Custom Engineered** — for those applications with more unique or complex requirements, these are individually engineered to the customer’s needs. *Consult your Eaton representative for assistance in pricing and lead time.*

Features

- NEMA Type 12 or Type 3R enclosures
- Input Voltage: 208V, 230V, 480V and 575V (Consult Factory)
- Complete range of control, network and power options
- Horsepower range:
  - 208V — 3/4 to 100 hp I_H; 1 to 100 hp I_L
  - 230V — 3/4 to 100 hp I_H; 1 to 100 hp I_L
  - 480V — 1 to 350 hp I_H; 1-1/2 to 400 hp I_L
- HMCP padlockable
- Single Phase input available — Consult factory

Technical Data and Specifications

Table 40-164. Specifications

Feature Description	9000X Enclosed Products — NEMA Type 12 or NEMA Type 3R
Primary Design Features	
45 – 66 Hz Input Frequency	Standard
Output: AC Volts Maximum	Input Voltage Base
Output Frequency Range: Hz	0 – 320
Initial Output Current (I_H)	250% for 2 seconds
Overload: 1 Minute (I_H/I_L)	150%/110%
Enclosure Space Heater	Optional
Oversize Enclosure	Standard
Output Contactor	Optional
Bypass Motor Starter	Optional
Listings	UL, cUL
Protection Features	
Incoming Line Fuses	Optional
AC Input Circuit Disconnect	Optional
Line Reactors	Standard
Phase Rotation Insensitive	Standard
EMI Filter	Standard — Thru Frame 9
Input Phase Loss Protection	Standard
Input Overvoltage Protection	Standard
Line Surge Protection	Standard
Output Short Circuit Protection	Standard
Output Ground Fault Protection	Standard
Output Phase Protection	Standard
Overtemperature Protection	Standard
DC Overvoltage Protection	Standard
Drive Overload Protection	Standard
Motor Overload Protection	Standard
Programmer Software	Optional
Local/Remote Keypad	Standard
Keypad Lockout	Standard
Fault Alarm Output	Standard
Built-In Diagnostics	Standard
Input/Output Interface Features	
Setup Adjustment Provisions:	
Remote Keypad/Display	Standard
Personal Computer	Standard
Operator Control Provisions:	
Drive Mounted Keypad/Display	Standard
Remote Keypad/Display	Standard
Conventional Control Elements	Standard
Serial Communications	Optional
115V AC Control Circuit	Optional
Speed Setting Inputs:	
Keypad	Standard
0 – 10V DC Potentiometer/ Voltage Signal	Standard
4 – 20 mA Isolated	Configurable
4 – 20 mA Differential	Configurable
Analog Outputs:	
Speed/Frequency	Standard
Torque/Load/Current	Programmable
Motor Voltage	Programmable
Kilowatts	Programmable
0 – 10V DC Signals	Configurable w/Jumpers
4 – 20 mA DC Signals	Standard
Isolated Signals	Optional

Feature Description	9000X Enclosed Products — NEMA Type 12 or NEMA Type 3R
Input/Output Interface Features (Continued)	
Discrete Outputs:	
Fault Alarm	Standard
Drive Running	Standard
Drive at Set Speed	Programmable
Optional Parameters	14
Dry Contacts	1 (2 Relays Form C)
Open Collector Outputs	1
Additional Discrete Outputs	Optional
Communications:	
RS-232	Standard
RS-422/485	Optional
DeviceNet™	Optional
Modbus RTU	Optional
CanOpen (Slave)	Optional
Profibus-DP	Optional
Lonworks®	Optional
Johnson Controls Metasys™ N2	Optional
Performance Features	
Sensorless Vector Control	Standard
Volts/Hertz Control	Standard
IR and Slip Compensation	Standard
Electronic Reversing	Standard
Dynamic Braking	Optional ①
DC Braking	Standard
PID Setpoint Controller	Programmable
Critical Speed Lockout	Standard
Current (Torque) Limit	Standard
Adjustable Acceleration/Deceleration	Standard
Linear or S Curve Accel/Decel	Standard
Jog at Preset Speed	Standard
Thread/Preset Speeds	7
Automatic Restart	Selectable
Coasting Motor Start	Standard
Coast or Ramp Stop Selection	Standard
Elapsed Time Meter	Optional
Carrier Frequency Adjustment	1 – 16 kHz
Standard Conditions for Application and Service	
Operating Ambient Temperature	0 – 40°C
Storage Temperature	-40 – 60°C
Humidity (Maximum), Non-condensing	95%
Altitude (Maximum without Derate)	3300 ft. (1000m)
Line Voltage Variation	+10/-15%
Line Frequency Variation	45 – 66 Hz
Efficiency	>96%
Power Factor (Displacement)	.96

① Some horsepower units include dynamic braking chopper as standard — refer to individual drive sections.

Table 40-165. Standard I/O Specifications

Description	Specification
6 – Digital Input Programmable	24V: "0" ≤ 10V, "1" ≥ 18V, R_i > 5 kΩ
2 – Analog Input Configurable w/Jumpers	Voltage: 0 – ±10V, R_i > 200 kΩ Current: 0 (4) – 20 mA, R_i = 250 kΩ
2 – Digital Output Programmable	Form C Relays 250V AC 2 Amp or 30V DC2 Amp resistive
1 – Digital Output Programmable	Open collector 48V DC 50 mA
1 – Analog Output Programmable Configurable w/Jumper	0 – 20 mA, impedance 500 ohms, resolution 106 ±3%

40

Catalog Number Selection

Table 40-166. SVX9000 Enclosed NEMA Type 12/3R Drive Catalog Numbering System

Build Alphabetically and Numerically

S V X 0 1 0 2 4 E P _ _ _ _ _ _ _ _ _ _

Product Family
SVX = Enclosed Drives

Horsepower Rating		
F07 = 3/4 hp	**010** = 10 hp	**060** = 60 hp
001 = 1 hp	**015** = 15 hp	**075** = 75 hp
F15 = 1-1/2 hp	**020** = 20 hp	**100** = 100 hp
002 = 2 hp	**025** = 25 hp	**125** = 125 hp
003 = 3 hp	**030** = 30 hp	**150** = 150 hp
005 = 5 hp	**040** = 40 hp	**200** = 200 hp
007 = 7-1/2 hp	**050** = 50 hp	
Consult Factory ①		
250 = 250 hp	**350** = 350 hp	
300 = 300 hp	**400** = 400 hp	

Enclosure Rating
2 = NEMA Type 12
3 = NEMA Type 3R

Voltage Rating	
Three-Phase	Single-Phase
1 = 208V	**J** = 230V
2 = 230V	**K** = 480V
4 = 480V	

Application — Torque/Braking ③
A = I_L/No Brake Chopper
B = I_L/Internal Brake Chopper
D = I_H/No Brake Chopper
E = I_H/Internal Brake Chopper

Enclosed Style
P = Pumping Application

Enclosed Options ②⑤⑥		Type
K1	Door-Mounted Speed Potentiometer ④	Control
K2	Door-Mounted Speed Potentiometer with HOA Selector Switch ④	Control
K5	Manual/Auto Reference Switch (22 mm)	Control
K6	Start & Stop Pushbuttons (22 mm)	Control
K9	(2) Factory Installed Auxiliary Contacts	Power
L1	Power On and Fault Pilot Lights	Light
L2	Bypass Pilot Lights for RA Bypass Option ⑧	Addl. Bypass
LD	Green Stop Light	Light
LE	Red Run Light	Light
LU	Light (22 mm)	Light
LW	PTT Light (22 mm)	Light
LY	Adder for LED Each	Light
P1	Input Disconnect (HMCP) 100 kAIC	Input
P3	Input Line Fuses (200 kAIC)	Input
P7	Input Power Surge Protection	Input
P8	TVSS Transient Voltage Surge Suppressor	Input
PE	Output Contactor	Output
RA	Manual HOA Bypass Controller ⑧	Bypass
S5	Floor Stand 22"	Enclosure
S9	Space Heater w/out CPT	Enclosure
SA	Space Heater w/CPT	Enclosure
SB	Socket Type Control Relay	Enclosure
SE	On-Delay Timer	Enclosure
SF	Off-Delay Timer	Enclosure

Communication Options ⑦
C2 = Modbus
C3 = Profibus DP
C4 = LonWorks
C5 = Profibus DP (D9 Connector)
C6 = CanOpen (Slave)
C7 = DeviceNet
C8 = Modbus (D9 Type Connector)
CA = Johnson Controls N2
CI = Modbus TCP
CJ = BACnet
CK = Ethernet IP
D3 = RS-232 with D9 Connection

Control Options
B1 = 6 DI, 1 ext +24V DC/EXT +24V DC
B2 = 1 RO (NC/NO), 1 RO (NO), 1 Therm
B4 = 1 AI (mA isolated), 2 AO (mA isolated), 1 ext +24V DC/EXT +24V DC
B5 = 3 RO (NO)
B8 = 1 ext +24V DC/EXT +24V DC, 3 Pt100
B9 = 1 RO (NO), 5 DI 42 – 240V AC Input

① Consult factory.
② Local/Remote keypad is included as the standard Control Panel.
③ Brake Chopper is a factory installed option only, see drive option tables on **Pages 40-118** – **40-123**. **Note:** External dynamic braking resistors not included. Consult factory.
④ Includes local/remote speed reference switch.
⑤ Some options are voltage and/or horsepower specific. Consult your Eaton representative for details.
⑥ See **Page 40-115** for descriptions.
⑦ See **Pages 40-116** and **40-117** for complete descriptions.
⑧ Bypass options applicable only in the Pump Panel three-phase design.

Control/Communication Option Descriptions

Table 40-167. Available Control/Communications Options

Option	Description	Option Type
K1	**Door-Mounted Speed Potentiometer** — Provides the SVX9000 with the ability to adjust the frequency reference using a door-mounted potentiometer. This option uses the 10V DC reference to generate a 0 – 10V signal at the analog voltage input signal terminal. When the HOA bypass option is added, the speed is controlled when the HOA switch is in the hand position. Without the HOA bypass option, a 2-position switch (labeled local/remote) is provided on the keypad to select speed reference from the Speed Potentiometer or a remote speed signal.	Control
K2	**Door-Mounted Speed Potentiometer with HOA Selector Switch** — Provides the SVX9000 with the ability to start/stop and adjust the speed reference from door-mounted control devices or remotely from customer supplied inputs. In HAND position, the drive will start and the speed is controlled by the door-mounted speed potentiometer. The drive will be disabled in the OFF position. When AUTO is selected, the drive run and speed control commands are via user-supplied dry contact and 4 – 20 mA signal.	Control
K5	**Manual/Auto Speed Reference Switch** — Provides a door-mounted selector switch for Manual/Auto speed reference.	Control
K6	**Start & Stop Pushbuttons (22 mm)** — Start (green) and Stop (red). Provides door-mounted Start and Stop pushbuttons for either bypass or non-bypass configurations.	Control
K9	**(2) Factory Installed Auxiliary Contacts** — Provides two NO/NC auxiliary contacts.	Power
L1	**Power On and Fault Pilot Lights** — Provides a white power on light that indicates power to the enclosed cabinet and a red fault light indicates a drive fault has occurred.	Light
L2	**Bypass Pilot Lights for RB, RA Bypass Options** — A green light indicates when the motor is running in inverter mode and an amber light indicates when the motor is running in bypass mode. The lights are mounted on the enclosure door, above the switches.	Addl. Bypass
LD	**Green Stop Light (22 mm)** — Provides a green light that indicates the drive is stopped.	Light
LE	**Run Pilot Light (22 mm)** — Provides a red run light that indicates the drive is running.	Light
LU	**Misc. Light (22 mm)** — Provides misc. “user defined” pilot light. User to define light function and color.	Light
LW	**PTT (Push-To-Test) Light (22 mm)** — Provides misc. “user defined” PTT pilot light. User to define light function and color.	Light
LY	**Adder for LED Each** — Changes light packages from standard incandescent bulb to LED style bulb.	Light
P1	**Input Disconnect Assembly Rated to 100 kAIC** — High Interrupting Motor Circuit Protector (HMCP) that provides a means of short circuit protection for the power cables between it and the SVX9000, and protection from high-level ground faults on the power cable. Allows a convenient means of disconnecting the SVX9000 from the line and the operating mechanism can be padlocked in the OFF position. This is factory mounted in the enclosure.	Input
P3	**Input Line Fuses Rated to 200 kAIC** — Provides high-level fault protection of the SVX9000 input power circuit from the load side of the fuses to the input side of the power transistors. This option consists of three 200 kA fuses, which are factory mounted in the enclosure.	Input
P7	**MOV Surge Suppressor** — Provides a Metal Oxide Varistor (MOV) connected to the line side terminals and is designed to clip line side transients.	Input
P8	**TVSS Transient Voltage Surge Suppressor** — Provides transient voltage surge suppression of the unit. Consult factory for ratings.	Input
PE	**Output Contactor** — Provides a means for positive disconnection of the drive output from the motor terminals. The contactor coil is controlled by the drive’s run or permissive logic. NC and NO auxiliary contacts rated at 10A, 600V AC are provided for customer use. Bypass Option **RA** includes an Output Contactor as standard. This option includes a low VA 115V AC fused Control Power Transformer and is factory mounted in the enclosure.	Output
RA	**Manual HOA Bypass Controller** — The Manual HAND/OFF/AUTO (HOA) — 3-contactor — bypass option provides a means of bypassing the SVX9000, allowing the AC motor to be operated at full speed directly from the AC supply line. This option consists of an input disconnect, a fused control power transformer, and a full voltage bypass starter with a door mounted HOA selector switch and an INVERTER/BYPASS switch. The HOA switch provides the ability to start and stop the drive in the inverter mode. For applications up to 100 hp, a Freedom Series IEC input contactor, a Freedom Series IEC output contactor, and a Freedom Series IEC starter with a bimetallic overload relay is included. For applications above 100 hp, an Advantage input contactor, an Advantage output contactor and an Advantage starter with electronic overload protection is included. The contactors are mechanically and electrically interlocked (see power diagram on **Page 40-112**).	Bypass
S5	**Floor Stand 22"** — Converts a Size A or B, normally wall mounted enclosure to a floor standing enclosure with a height of 22" (558.8 mm).	Enclosure
S9	**Space Heater without CPT** — Prevents condensation from forming in the enclosure when the drive is inactive or in storage. Includes a thermostat for variable temperature control. A 200W heater is installed in enclosures A and B, and 400W heater is installed in enclosures C – D. Requires a customer supplied 115V remote supply source.	Enclosure
SA	**Space Heater with CPT**— Prevents condensation from forming in the enclosure when the drive is inactive or in storage. Includes a thermostat for variable temperature control. A 200W heater is installed in enclosures A and B, and 400W heater is installed in enclosures C – D. Provided with CPT connected to load side of input disconnect.	Enclosure
SB	**Ice Cube Style Control Relay** — Provides misc. “user defined” 4PDT control relay. Requires user to define functionality.	Enclosure
SE	**On-Delay Timer (Delay on Make)** — Provides misc. “user defined” time delay relay. Requires user to define functionality and time setting requirement.	Enclosure
SF	**Off-Delay Timer (Delay on Break)** — Provides misc. “user defined” time delay relay. Requires user to define functionality and time setting requirement.	Enclosure

Note: For availability, see Product Selection for base drive voltage required.

9000X Series Option Board Kits

The 9000X Series drives can accommodate a wide selection of expander and adapter option boards to customize the drive for your application needs. The drive's control unit is designed to accept a total of five option boards (see **Figure 40-54**).

The 9000X Series factory installed standard board configuration includes an A9 I/O board and an A2 relay output board, which are installed in slots A and B.

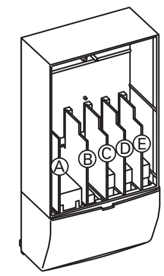


Figure 40-54. 9000X Series Option Boards

Table 40-168. Option Board Kits

Option Kit Description ②	Allowed Slot Locations ①	Field Installed Catalog Number	Field Installed Price U.S. $	Factory Installed Option Designator	Factory Installed Adder U.S. $	SVX Ready Programs Basic	Local/ Remote	Standard	MSS	PID	Multi-P.	PFC
Standard I/O Cards (See Figure 40-54)												
2 RO (NC/NO)	B	**OPTA2**		**—**		X	X	X	X	X	X	X
6 DI, 1 DO, 2 AI, 1AO, 1 +10V DC ref, 2 ext +24V DC/ EXT +24V DC	A	**OPTA9**		**—**		X	X	X	X	X	X	X
Extended I/O Card Options												
6 DI, 1 ext +24V DC/EXT +24V DC	B, C, **D**, E	**OPTB1**		**B1**		—	—	—	—	—	X	X
1 RO (NC/NO), 1 RO (NO), 1 Therm	B, C, **D**, E	**OPTB2**		**B2**		—	—	—	—	—	X	X
1 AI (mA isolated), 2 AO (mA isolated), 1 ext +24V DC/EXT +24V DC	B, C, **D**, E	**OPTB4**		**B4**		X	X	X	X	X	X	X
3 RO (NO)	B, C, **D**, E	**OPTB5**		**B5**		—	—	—	—	—	X	X
1 ext +24V DC/EXT +24V DC, 3 Pt100	B, C, **D**, E	**OPTB8**		**B8**		—	—	—	—	—	—	—
1 RO (NO), 5 DI 42 – 240V AC Input	B, C, **D**, E	**OPTB9**		**B9**		—	—	—	—	—	X	X
Communication Cards ③												
Modbus	D, **E**	**OPTC2**		**C2**		X	X	X	X	X	X	X
Modbus TCP	D, **E**	**OPTCI**		**CI**		X	X	X	X	X	X	X
BACnet	D, **E**	**OPTCJ**		**CJ**		X	X	X	X	X	X	X
Ethernet IP	D, **E**	**OPTCK**		**CK**		X	X	X	X	X	X	X
Johnson Controls N2	D, **E**	**OPTC2**		**CA**		—	—	—	—	—	—	—
Profibus DP	D, **E**	**OPTC3**		**C3**		X	X	X	X	X	X	X
LonWorks	D, **E**	**OPTC4**		**C4**		X	X	X	X	X	X	X
Profibus DP (D9 Connector)	D, **E**	**OPTC5**		**C5**		X	X	X	X	X	X	X
CanOpen (Slave)	D, **E**	**OPTC6**		**C6**		X	X	X	X	X	X	X
DeviceNet	D, **E**	**OPTC7**		**C7**		X	X	X	X	X	X	X
Modbus (D9 Type Connector)	D, **E**	**OPTC8**		**C8**		X	X	X	X	X	X	X
RS-232 with D9 Connection	D, **E**	**OPTD3**		**D3**		X	X	X	X	X	X	X
Keypad												
9000X Series Local Remote Keypad	—	**KEYPAD-LOC/REM**		**—**		—	—	—	—	—	—	—
9000X Series Remote Mount Keypad Kit (Keypad not included)	—	**OPTRMT-KIT-9000X**		**—**		—	—	—	—	—	—	—
9000X Series RS-232 Cable, 13 ft.	—	**PP00104**		**—**		—	—	—	—	—	—	—

① Option card must be installed in one of the slots listed for that card. Slot indicated in Bold is the preferred location.
② AI = Analog Input; AO = Analog Output, DI = Digital Input, DO = Digital Output, RO = Relay Output
③ OPTC2 is a multi-protocol option card.

Discount Symbol....................... **SS-2**

Modbus RTU Network Communications

The Modbus Network Card OPTC2 is used for connecting the 9000X Drive as a slave on a Modbus network. The interface is connected by a 9-pin DSUB connector (female) and the baud rate ranges from 300 to 19200 baud. Other communication parameters include an address range from 1 to 247; a parity of None, Odd or Even; and the stop bit is 1.

Profibus Network Communications

The Profibus Network Card OPTC3 is used for connecting the 9000X Drive as a slave on a Profibus-DP network. The interface is connected by a 9-pin DSUB connector (female). The baud rates range from 9.6K baud to 12M baud, and the addresses range from 1 to 127.

LonWorks Network Communications

The LonWorks Network Card OPTC4 is used for connecting the 9000X Drive on a LonWorks network. This interface uses Standard Network Variable Types (SNVT) as data types. The channel connection is achieved using a FTT-10A Free Topology transceiver via a single twisted transfer cable. The communication speed with LonWorks is 78 kBits/s.

CanOpen (Slave) Communications

The CanOpen (Slave) Network Card OPTC6 is used for connecting the 9000X Drive to a host system. According to ISO11898 standard cables to be chosen for CAN bus should have a nominal impedance of 120Ω, and specific line delay of nominal 5 nS/m. 120Ω line termination resistors required for installation.

DeviceNet Network Communications

The DeviceNet Network Card OPTC7 is used for connecting the 9000X Drive on a DeviceNet Network. It includes a 5.08 mm pluggable connector. Transfer method is via CAN using a 2-wire twisted shielded cable with 2-wire bus power cable and drain. The baud rates used for communication include 125K baud, 250K baud and 500K baud.

Johnson Controls Metasys™ N2 Network Communications

The OPTC2 fieldbus board provides communication between the 9000X Drive and a Johnson Controls Metasys™ N2 network. With this connection, the drive can be controlled, monitored and programmed from the Metasys system. The N2 fieldbus is available as a factory installed option and as a field installable kit.

Modbus/TCP Network Communications

The Modbus/TCP Network Card OPTCI is used for connecting the 9000X Drive to Ethernet networks utilizing Modbus protocol. It includes an RJ-45 pluggable connector. This interface provides a selection of standard and custom register values to communicate drive parameters. The board supports 10 Mbps and 100 Mbps communication speeds. The IP address of the board is configurable over Ethernet using a supplied software tool.

BACnet Network Communications

The BACnet Network Card OPTCJ is used for connecting the 9000X Drive to BACnet networks. It includes a 5.08 mm pluggable connector. Data transfer is Master-Slave/Token Passing (MS/TP) RS-485. This interface uses a collection of 30 Binary Value Objects (BVOs) and 35 Analog Value Objects (AVOs) to communicate drive parameters. The card supports 9.6, 19.2 and 38.4 Kbaud communication speeds and supports network addresses 1 – 127.

Ethernet/IP Network Communications

The Ethernet/IP Network Card OPTCK is used for connecting the 9000X Drive to Ethernet/Industrial Protocol networks. It includes an RJ-45 pluggable connector. The interface uses CIP objects to communicate drive parameters (CIP is “Common Industrial Protocol”, the same protocol used by DeviceNet). The board supports 10 Mbps and 100 Mbps communication speeds. The IP address of the board is configurable by Static, BOOTP and DHCP methods.

Table 40-169. I/O Specifications for the Control/Communication Options

Description	Specifications
Analog voltage, input	0 – ±10V, R_i ≥ 200 kΩ
Analog current, input	0 (4) – 20 mA, R_i = 250 Ω
Digital Input	24V: “0” ≤ 10V, “1” ≥ 18V, R_i > 5 kΩ
Aux. voltage	24V (±20%), max. 50 mA
Reference voltage	10V ±3%, max. 10 mA
Analog current, output Analog voltage, output	0 (4) – 20 mA, R_L = 500 kΩ, resolution 10 bit, accuracy ≤ ±2% 0 (2) – 10V, R_L ≥ 1 kΩ, resolution 10 bit, accuracy ≤ ±2%
Relay output Max. switching voltage Max. switching load Max. continuous load	 300V DC, 250V AC 8A/24V DC, .4A/300V DC, 2 kVA/250V AC 2A rms
Thermistor input	R_{trip} = 4.7 kΩ

Product Selection

When Ordering

- Select a Base Catalog Number that meets the application requirements — nominal horsepower, voltage and enclosure rating (the enclosed drive's continuous output amp rating should be equal to or greater than the motor's full load amp rating). The base enclosed package includes a standard drive, door mounted Local/Remote Keypad and enclosure.
- If Dynamic Brake Chopper or Control/Communication option is desired, change the appropriate code in the Base Catalog Number.
- Select Enclosed Options. Add the codes as suffixes to the Base Catalog Number in alphabetical and numeric order.
- **Read all Footnotes.**

208V Drives

Table 40-170. 208V Pump Panel Style (Three-Phase)

Enclosure Size ①	hp	NEMA Type 12			NEMA Type 3R		
		Frame Size	Base Catalog Number ②	Price U.S. $ ②	Frame Size	Base Catalog Number ②	Price U.S. $ ②
208V High Overload Drive and Enclosure							
A	3/4	4	**SVXF0721EP**		4	**SVXF0731EP**	
A	1		**SVX00121EP**			**SVX00131EP**	
A	1-1/2		**SVXF1521EP**			**SVXF1531EP**	
A	2		**SVX00221EP**			**SVX00231EP**	
A	3	5	**SVX00321EP**		5	**SVX00331EP**	
A	5		**SVX00521EP**			**SVX00531EP**	
A	7-1/2		**SVX00721EP**			**SVX00731EP**	
A	10	6	**SVX01021EP**		6	**SVX01031EP**	
B	15		**SVX01521EP**			**SVX01531EP**	
B	20	7	**SVX02021DP**		7	**SVX02031DP**	
B	25		**SVX02521DP**			**SVX02531DP**	
C	30		**SVX03021DP**			**SVX03031DP**	
C	40	8	**SVX04021DP**		8	**SVX04031DP**	
C	50		**SVX05021DP**			**SVX05031DP**	
D	60		**SVX06021DP**			**SVX06031DP**	
D	75	9	**SVX07521DP**		9	**SVX07531DP**	
D	100		**SVX10021DP**			**SVX10031DP**	
208V Low Overload Drive and Enclosure							
A	1	4	**SVX00121BP**		4	**SVX00131BP**	
A	1-1/2		**SVXF1521BP**			**SVXF1531BP**	
A	2		**SVX00221BP**			**SVX00231BP**	
A	3		**SVX00321BP**			**SVX00331BP**	
A	5	5	**SVX00521BP**		5	**SVX00531BP**	
A	7-1/2		**SVX00721BP**			**SVX00731BP**	
A	10		**SVX01021BP**			**SVX01031BP**	
A	15	6	**SVX01521BP**		6	**SVX01531BP**	
B	20		**SVX02021BP**			**SVX02031BP**	
B	25	7	**SVX02521AP**		7	**SVX02531AP**	
B	30		**SVX03021AP**			**SVX03031AP**	
C	40		**SVX04021AP**			**SVX04031AP**	
C	50	8	**SVX05021AP**		8	**SVX05031AP**	
C	60		**SVX06021AP**			**SVX06031AP**	
D	75		**SVX07521AP**			**SVX07531AP**	
D	100	9	**SVX10021AP**		9	**SVX10031AP**	

① Enclosure dimensions listed on **Pages 40-124 – 40-129.**
② Includes drive, Local/Remote Keypad and enclosure.

Table 40-171. 208V Brake Chopper Adder ③

I_H hp	Adder U.S. $	I_L hp	Adder U.S. $
	NEMA Type 12/3R		NEMA Type 12/3R
3/4		—	
1		1	
1-1/2		1-1/2	
2		2	
3		3	
5		5	
7-1/2		7-1/2	
10		10	
15		15	
20		20	
25		25	
30		30	
40		40	
50		50	
60		60	
75		75	
100		100	

③ External dynamic braking resistors not included. Consult factory.

Discount Symbol **SS-2**

Table 40-172. 208V Control Options

Catalog Number Suffix ⇒	Door-Mounted Speed Potentiometer	Door-Mounted Speed Potentiometer with HOA Selector Switch	Manual/Auto Reference Switch (22 mm)	Start & Stop Pushbuttons (22 mm)
	K1	K2	K5	K6
hp	Adder U.S. $	Adder U.S. $	Adder U.S. $	Adder U.S. $
3/4 – 100				

Table 40-173. 208V Light Options

Catalog Number Suffix ⇒	Power On/ Fault Pilot Lights (22 mm)	Green Stop Light (22 mm)	Red Run Light (22 mm)	Misc. Light (22 mm)	PTT Light (22 mm)	Adder for LED Each
	L1	LD	LE	LU	LW	LY
hp	Adder U.S. $	Adder U.S. $	Adder U.S. $	Adder U.S. $	Adder U.S. $	Adder U.S. $
3/4 – 100						

Table 40-174. 208V Enclosure Options

Catalog Number Suffix ⇒	Floor Stand 22" (558.8 mm)	Space Heater w/out CPT	Space Heater w/CPT	Socket Type Control Relay	On-Delay Timer	Off-Delay Timer
	S5	S9	SA	SB	SE	SF
Enclosure Size	Adder U.S. $	Adder U.S. $	Adder U.S. $	Adder U.S. $	Adder U.S. $	Adder U.S. $
A						
B						
C						
D						

Table 40-175. 208V Power Options

Catalog Number Suffix ⇒	Input					Output
	Two Auxiliary Contacts Installed	Input Disconnect (HMCP) 100 kAIC	Input Line Fuses 200 kAIC	Input Power Surge Protection	TVSS Transient Voltage Surge Suppressor	Output Contactor
	K9	P1	P3	P7	P8	PE
hp	Adder U.S. $	Adder U.S. $	Adder U.S. $	Adder U.S. $	Adder U.S. $	Adder U.S. $
3/4 – 5						
7-1/2 10 15 20						
25 – 30						
40						
50 – 60						
75 100						

Table 40-176. 208V Bypass Options

Catalog Number Suffix ⇒	Bypass Pilot Lights for RA Option	Manual HOA Bypass Controller
	L2	RA
hp	Adder U.S. $	Adder U.S. $
3/4 – 7-1/2		
10		
15 – 20		
25 – 30		
40		
50 – 60		
75 100		

Discount Symbol **SS-2**

230V Drives

Table 40-177. 230V Pump Panel Style (Three-Phase)

Enclosure Size ①	hp	NEMA Type 12			NEMA Type 3R		
		Frame Size	Base Catalog Number ②	Price U.S. $ ②	Frame Size	Base Catalog Number ②	Price U.S. $ ②
230V High Overload Drive and Enclosure							
A A A A	3/4 1 1-1/2 2	4	**SVXF0722EP** **SVX00122EP** **SVXF1522EP** **SVX00222EP**		4	**SVXF0732EP** **SVX00132EP** **SVXF1532EP** **SVX00232EP**	
A A A	3 5 7-1/2	5	**SVX00322EP** **SVX00522EP** **SVX00722EP**		5	**SVX00332EP** **SVX00532EP** **SVX00732EP**	
A B	10 15	6	**SVX01022EP** **SVX01522EP**		6	**SVX01032EP** **SVX01532EP**	
B B C	20 25 30	7	**SVX02022DP** **SVX02522DP** **SVX03022DP**		7	**SVX02032DP** **SVX02532DP** **SVX03032DP**	
C C D	40 50 60	8	**SVX04022DP** **SVX05022DP** **SVX06022DP**		8	**SVX04032DP** **SVX05032DP** **SVX06032DP**	
D D	75 100	9	**SVX07522DP** **SVX10022DP**		9	**SVX07532DP** **SVX10032DP**	
230V Low Overload Drive and Enclosure							
A A A A	1 1-1/2 2 3	4	**SVX00122BP** **SVXF1522BP** **SVX00222BP** **SVX00322BP**		4	**SVX00132BP** **SVXF1532BP** **SVX00232BP** **SVX00332BP**	
A A A	5 7-1/2 10	5	**SVX00522BP** **SVX00722BP** **SVX01022BP**		5	**SVX00532BP** **SVX00732BP** **SVX01032BP**	
A B	15 20	6	**SVX01522BP** **SVX02022BP**		6	**SVX01532BP** **SVX02032BP**	
B B C	25 30 40	7	**SVX02522AP** **SVX03022AP** **SVX04022AP**		7	**SVX02532AP** **SVX03032AP** **SVX04032AP**	
C C D	50 60 75	8	**SVX05022AP** **SVX06022AP** **SVX07522AP**		8	**SVX05032AP** **SVX06032AP** **SVX07532AP**	
D	100	9	**SVX10022AP**		9	**SVX10032AP**	

① Enclosure dimensions listed on **Pages 40-124 – 40-129**.
② Includes drive, Local/Remote Keypad and enclosure.

Table 40-178. 230V Pump Panel Style (Single-Phase)

Enclosure Size ③	hp	NEMA Type 12			NEMA Type 3R		
		Frame Size	Base Catalog Number ④	Price U.S. $ ④	Frame Size	Base Catalog Number ④	Price U.S. $ ④
230V Low Overload Drive and Enclosure							
A A	3/4 1	4	**SVXF072JBP** **SVX0012JBP**		4	**SVXF073JBP** **SVX0013JBP**	
A A A	2 3 5	5	**SVX0022JBP** **SVX0032JBP** **SVX0052JBP**		5	**SVX0023JBP** **SVX0033JBP** **SVX0053JBP**	
A A	7-1/2 10	6	**SVX0072JBP** **SVX0102JBP**		6	**SVX0073JBP** **SVX0103JBP**	
B B	15 20	7	**SVX0152JBP** **SVX0202JAP**		7	**SVX0153JBP** **SVX0203JAP**	
C C C	25 30 40	8	**SVX0252JAP** **SVX0302JAP** **SVX0402JAP**		8	**SVX0253JAP** **SVX0303JAP** **SVX0403JAP**	

③ Enclosure dimensions listed on **Pages 40-124 – 40-129**.
④ Includes drive, Local/Remote Keypad and enclosure.

Table 40-179. 230V Brake Chopper Adder ⑤

I_H hp	Adder U.S. $	I_L hp	Adder U.S. $
	NEMA Type 12/3R		NEMA Type 12/3R
3/4 1 1-1/2 2		— 1 1-1/2 2	
3 5 7-1/2 10		3 5 7-1/2 10	
15 20 25 30 40		15 20 25 30 40	
50 60 75 100		50 60 75 100	

⑤ External dynamic braking resistors not included. Consult factory.

Discount Symbol **SS-2**

Table 40-180. 230V Control Options

Catalog Number Suffix ➡	Door-Mounted Speed Potentiometer	Door-Mounted Speed Potentiometer with HOA Selector Switch	Manual/Auto Reference Switch (22 mm)	Start & Stop Pushbuttons (22 mm)
	K1	K2	K5	K6
hp	Adder U.S. $	Adder U.S. $	Adder U.S. $	Adder U.S. $
3/4 – 100				

Table 40-181. 230V Light Options

Catalog Number Suffix ➡	Power On/ Fault Pilot Lights (22 mm)	Green Stop Light (22 mm)	Red Run Light (22 mm)	Misc. Light (22 mm)	PTT Light (22 mm)	Adder for LED Each
	L1	LD	LE	LU	LW	LY
hp	Adder U.S. $	Adder U.S. $	Adder U.S. $	Adder U.S. $	Adder U.S. $	Adder U.S. $
3/4 – 100						

Table 40-182. 230V Enclosure Options

Catalog Number Suffix ➡	Floor Stand 22" (558.8 mm)	Space Heater w/out CPT	Space Heater w/CPT	Socket Type Control Relay	On-Delay Timer	Off-Delay Timer
	S5	S9	SA	SB	SE	SF
Enclosure Size	Adder U.S. $	Adder U.S. $	Adder U.S. $	Adder U.S. $	Adder U.S. $	Adder U.S. $
A						
B						
C						
D						

Table 40-183. 230V Power Options

Catalog Number Suffix ➡	Input					Output
	Two Auxiliary Contacts Installed	Input Disconnect (HMCP) 100 kAIC	Input Line Fuses 200 kAIC	Input Power Surge Protection	TVSS Transient Voltage Surge Suppressor	Output Contactor
	K9	P1	P3	P7	P8	PE
hp	Adder U.S. $	Adder U.S. $	Adder U.S. $	Adder U.S. $	Adder U.S. $	Adder U.S. $
3/4 – 5						
7-1/2 – 10						
15						
20 – 25						
30 – 40						
50						
60 – 75						
100						

Table 40-184. 230V Bypass Options ①

Catalog Number Suffix ➡	Bypass Pilot Lights for RA Option	Manual HOA Bypass Controller
	L2 ②	RA ②
hp	Adder U.S. $	Adder U.S. $
3/4 – 10		
15		
20 – 25		
30 – 40		
50		
60 – 75		
100		

① See **Page 40-115** for details.
② Bypass options applicable only in the Pump Panel three-phase design.

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Discount Symbol....................... **SS-2**

480V Drives

Table 40-185. 480V Pump Panel Style (Three-Phase)

Enclosure Size ①	hp	NEMA Type 12 Frame Size	NEMA Type 12 Base Catalog Number ②	NEMA Type 12 Price U.S. $ ②	NEMA Type 3R Frame Size	NEMA Type 3R Base Catalog Number ②	NEMA Type 3R Price U.S. $ ②
480V High Overload Drive and Enclosure							
A	1	4	**SVX00124EP**		4	**SVX00134EP**	
A	1-1/2		**SVXF1524EP**			**SVXF1534EP**	
A	2		**SVX00224EP**			**SVX00234EP**	
A	3		**SVX00324EP**			**SVX00334EP**	
A	5		**SVX00524EP**			**SVX00534EP**	
A	7-1/2	5	**SVX00724EP**		5	**SVX00734EP**	
A	10		**SVX01024EP**			**SVX01034EP**	
A	15		**SVX01524EP**			**SVX01534EP**	
A	20	6	**SVX02024EP**		6	**SVX02034EP**	
A	25		**SVX02524EP**			**SVX02534EP**	
B	30		**SVX03024EP**			**SVX03034EP**	
B	40	7	**SVX04024DP**		7	**SVX04034DP**	
B	50		**SVX05024DP**			**SVX05034DP**	
B	60		**SVX06024DP**			**SVX06034DP**	
C	75	8	**SVX07524DP**		8	**SVX07534DP**	
C	100		**SVX10024DP**			**SVX10034DP**	
C	125		**SVX12524DP**			**SVX12534DP**	
D	150	9	**SVX15024DP**		9	**SVX15034DP**	
D	200		**SVX20024DP**			**SVX20034DP**	
TBD	250	10	**SVX25024DP**		10	**SVX25034DP**	
TBD	300		**SVX30024DP**			**SVX30034DP**	
TBD	350		**SVX35024DP**			**SVX35034DP**	
480V Low Overload Drive and Enclosure							
A	1-1/2	4	**SVXF1524BP**		4	**SVXF1534BP**	
A	2		**SVX00224BP**			**SVX00234BP**	
A	3		**SVX00324BP**			**SVX00334BP**	
A	5		**SVX00524BP**			**SVX00534BP**	
A	7-1/2		**SVX00724BP**			**SVX00734BP**	
A	10	5	**SVX01024BP**		5	**SVX01034BP**	
A	15		**SVX01524BP**			**SVX01534BP**	
A	20		**SVX02024BP**			**SVX02034BP**	
A	25	6	**SVX02524BP**		6	**SVX02534BP**	
A	30		**SVX03024BP**			**SVX03034BP**	
B	40		**SVX04024BP**			**SVX04034BP**	
B	50	7	**SVX05024AP**		7	**SVX05034AP**	
B	60		**SVX06024AP**			**SVX06034AP**	
B	75		**SVX07524AP**			**SVX07534AP**	
C	100	8	**SVX10024AP**		8	**SVX10034AP**	
C	125		**SVX12524AP**			**SVX12534AP**	
C	150		**SVX15024AP**			**SVX15034AP**	
D	200	9	**SVX20024AP**		9	**SVX20034AP**	
D	250		**SVX25024AP**			**SVX25034AP**	
TBD	300	10	**SVX30024AP**		10	**SVX30034AP**	
TBD	400		**SVX40024AP**			**SVX40034AP**	

① Enclosure dimensions listed on **Pages 40-124 – 40-129.**
② Includes drive, Local/Remote keypad and enclosure.

Table 40-186. 480V Pump Panel Style (Single-Phase)

Enclosure Size ③	hp	NEMA Type 12 Frame Size	NEMA Type 12 Base Catalog Number ④	NEMA Type 12 Price U.S. $ ④	NEMA Type 3R Frame Size	NEMA Type 3R Base Catalog Number ④	NEMA Type 3R Price U.S. $ ④
480V Low Overload Drive and Enclosure							
A	3/4	4	**SVXF072KBP**		4	**SVXF073KBP**	
A	1		**SVX0012KBP**			**SVX0013KBP**	
A	2		**SVX0022KBP**			**SVX0023KBP**	
A	3		**SVX0032KBP**			**SVX0033KBP**	
A	5	5	**SVX0052KBP**		5	**SVX0053KBP**	
A	7-1/2		**SVX0072KBP**			**SVX0073KBP**	
A	10		**SVX0102KBP**			**SVX0103KBP**	
A	15	6	**SVX0152KBP**		6	**SVX0153KBP**	
A	20		**SVX0202KBP**			**SVX0203KBP**	
B	25	7	**SVX0252KAP**		7	**SVX0253KAP**	
B	30		**SVX0302KAP**			**SVX0303KAP**	
C	40	8	**SVX0402KAP**		8	**SVX0403KAP**	
C	50		**SVX0502KAP**			**SVX0503KAP**	
C	60		**SVX0602KAP**			**SVX0603KAP**	

③ Enclosure dimensions listed on **Pages 40-124 – 40-129.**
④ Includes drive, Local/Remote keypad and enclosure.

Table 40-187. 480V Brake Chopper Adder ⑤

I_H hp	Adder U.S. $ NEMA Type 12/3R	I_L hp	Adder U.S. $ NEMA Type 12/3R
1		—	
1-1/2		1-1/2	
2		2	
3		3	
5		5	
7-1/2		7-1/2	
10		10	
15		15	
20		20	
25		25	
30		30	
40		40	
50		50	
60		60	
75		75	
100		100	
125		125	
150		150	
200		200	
250		250	
300		300	
350		350	
400		400	

⑤ External dynamic braking resistors not included. Consult factory.

Discount Symbol **SS-2**

Table 40-188. 480V Control Options

Catalog Number Suffix ⇒	Door-Mounted Speed Potentiometer	Door-Mounted Speed Potentiometer with HOA Selector Switch	Manual/Auto Reference Switch (22 mm)	Start & Stop Pushbuttons (22 mm)
	K1	K2	K5	K6
hp	Adder U.S. $	Adder U.S. $	Adder U.S. $	Adder U.S. $
3/4 – 100				

Table 40-189. 480V Light Options

Catalog Number Suffix ⇒	Power On/ Fault Pilot Lights (22 mm)	Green Stop Light (22 mm)	Red Run Light (22 mm)	Misc. Light (22 mm)	PTT Light (22 mm)	Adder for LED Each
	L1	LD	LE	LU	LW	LY
hp	Adder U.S. $	Adder U.S. $	Adder U.S. $	Adder U.S. $	Adder U.S. $	Adder U.S. $
3/4 – 100						

Table 40-190. 480V Enclosure Options

Catalog Number Suffix ⇒	Floor Stand 22" (558.8 mm)	Space Heater w/out CPT	Space Heater w/CPT	Socket Type Control Relay	On-Delay Timer	Off-Delay Timer
	S5	S9	SA	SB	SE	SF
Enclosure Size	Adder U.S. $	Adder U.S. $	Adder U.S. $	Adder U.S. $	Adder U.S. $	Adder U.S. $
A						
B						
C						
D						

Table 40-191. 480V Power Options

Catalog Number Suffix ⇒	Input					Output
	Two Auxiliary Contacts Installed	Input Disconnect (HMCP) 100 kAIC	Input Line Fuses 200 kAIC	Input Power Surge Protection	TVSS Transient Voltage Surge Suppressor	Output Contactor
	K9	P1	P3	P7	P8	PE
hp	Adder U.S. $	Adder U.S. $	Adder U.S. $	Adder U.S. $	Adder U.S. $	Adder U.S. $
1 – 10						
15 – 20						
25 – 30						
40 – 50						
60 – 75						
100						
125 – 150						
200						
250						
300 – 350						
400						

Table 40-192. 480V Bypass Options ①

Catalog Number Suffix ⇒	Bypass Pilot Lights for RA Option	Manual HOA Bypass Controller
	L2 ②	RA ②
hp	Adder U.S. $	Adder U.S. $
1 – 20		
25		
30		
40 – 50		
60 – 75		
100		
125 – 150		
200		
250 – 350		
400		

① See **Page 40-115** for details.
② Bypass options applicable only in the Pump Panel three-phase design.

Dimensions

Enclosure Box A NEMA Type 12

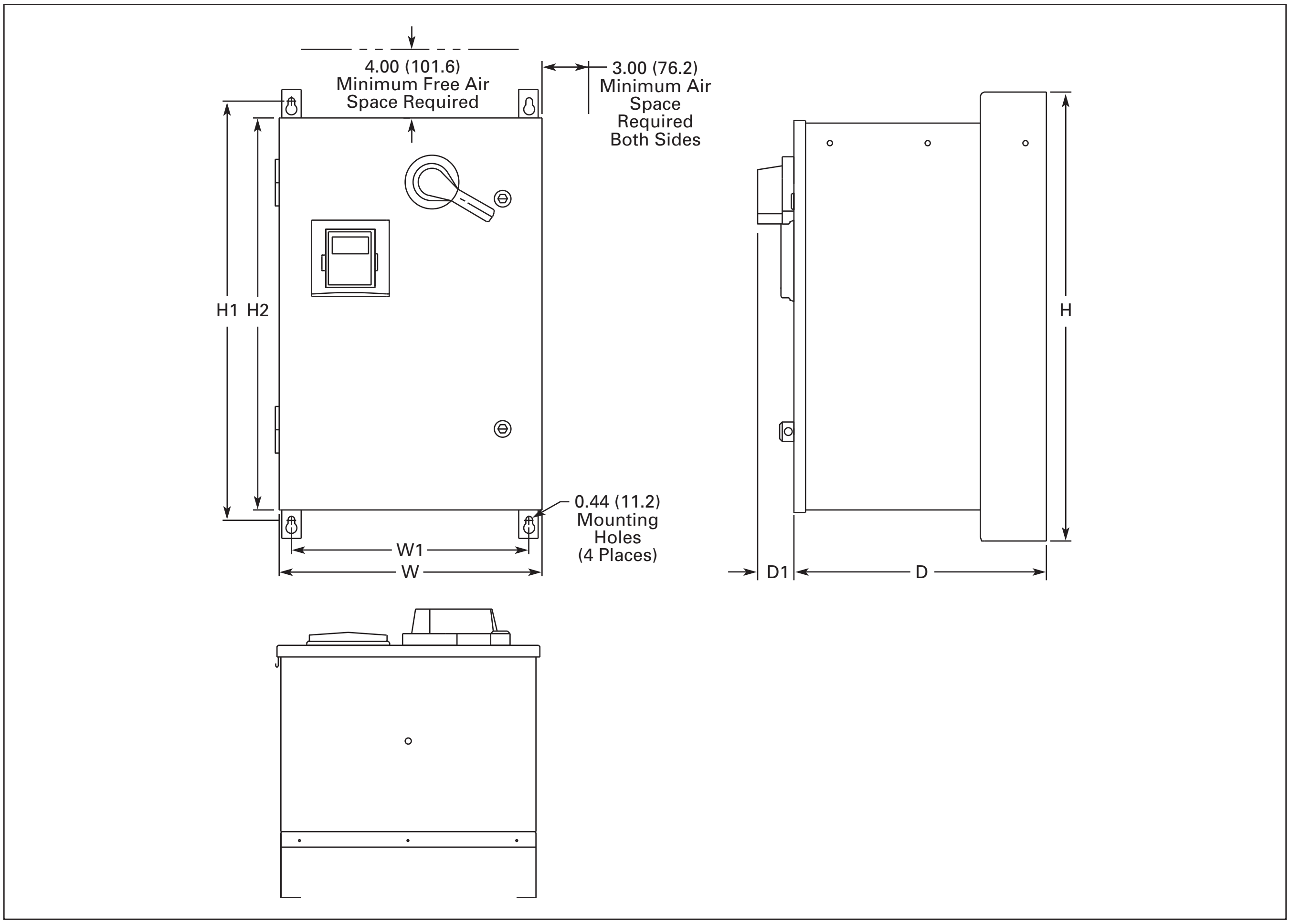


Figure 40-55. NEMA Type 12 SVX9000 Pump Application Drive Dimensions

Table 40-193. NEMA Type 12 SVX9000 Pump Application Drive Dimensions

Voltage AC	hp (I_H)	hp (I_L)	Approximate Dimensions in Inches (mm)							Approx. Weight Lbs. (kg)	Approx. Ship Weight Lbs. (kg)
			H	H1	H2	W	W1	D	D1		
Three-Phase											
208V	3/4 – 10	1 – 15	29.00 (736.6)	27.00 (685.8)	25.35 (643.9)	16.92 (429.8)	15.30 (388.6)	16.26 (413.0)	2.34 (59.4)	120 (54)	160 (73)
230V	3/4 – 10	1 – 15									
480V	1 – 25	1 – 30									
Single-Phase											
230V	—	3/4 – 10	29.00 (736.6)	27.00 (685.8)	25.35 (643.9)	16.92 (429.8)	15.30 (388.6)	16.26 (413.0)	2.34 (59.4)	120 (54)	160 (73)
480V	—	3/4 – 20									

Enclosure Box B NEMA Type 12

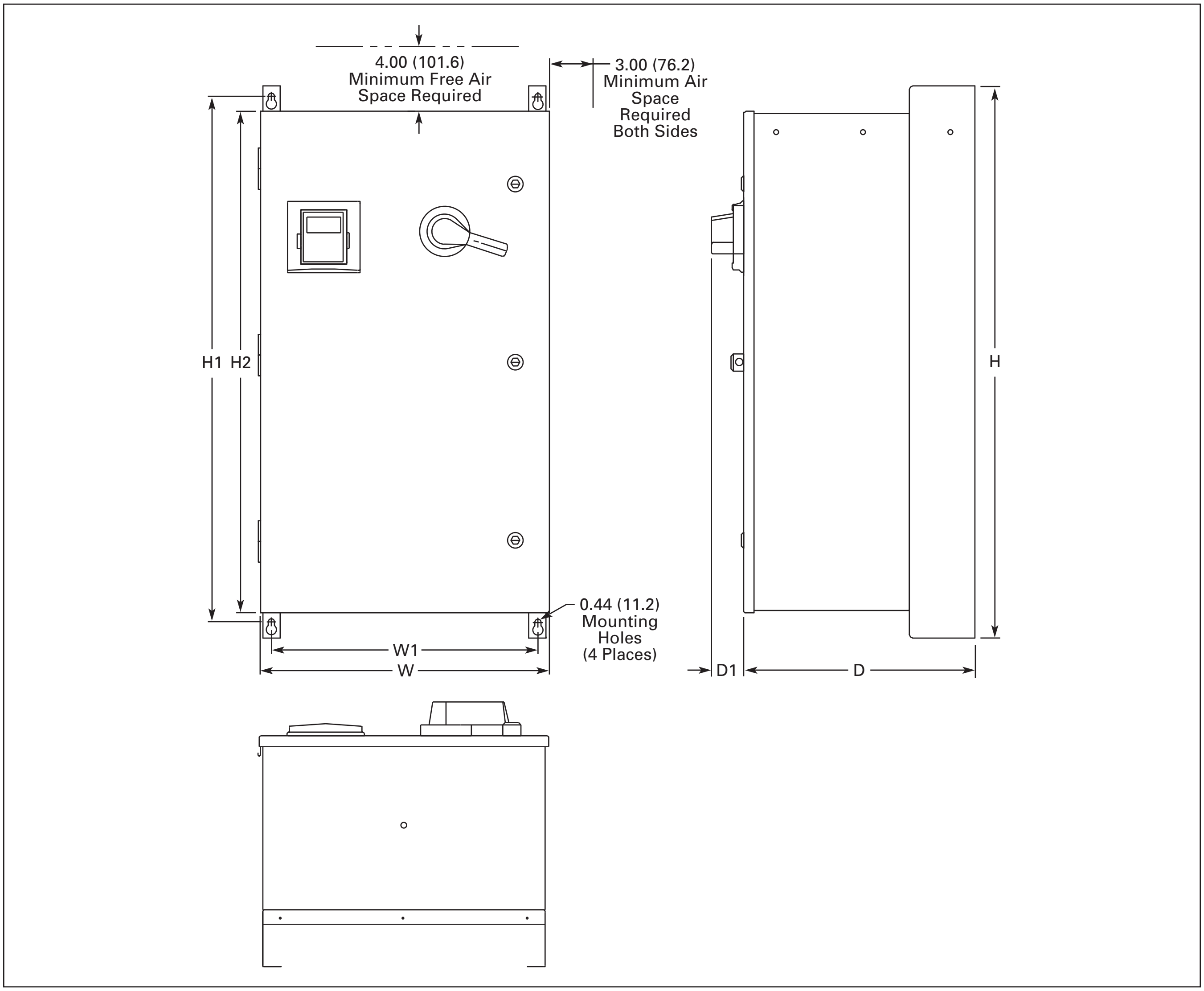


Figure 40-56. NEMA Type 12 SVX9000 Pump Application Drive Dimensions

Table 40-194. NEMA Type 12 SVX9000 Pump Application Drive Dimensions

Voltage AC	hp (I_H)	hp (I_L)	Approximate Dimensions in Inches (mm)							Approx. Weight Lbs. (kg)	Approx. Ship Weight Lbs. (kg)
			H	H1	H2	W	W1	D	D1		
Three-Phase											
208V	15 – 25	20 – 30	40.00 (1016.0)	38.00 (965.2)	36.35 (923.3)	20.92 (531.4)	19.30 (490.2)	16.76 (425.7)	2.34 (59.4)	185 (84)	229 (104)
230V	15 – 25	20 – 30									
480V	30 – 60	40 – 75									
Single-Phase											
230V	—	15 – 20	40.00 (1016.0)	38.00 (965.2)	36.35 (923.3)	20.92 (531.4)	19.30 (490.2)	16.76 (425.7)	2.34 (59.4)	185 (84)	229 (104)
480V	—	25 – 30									

Enclosure Box C NEMA Type 12

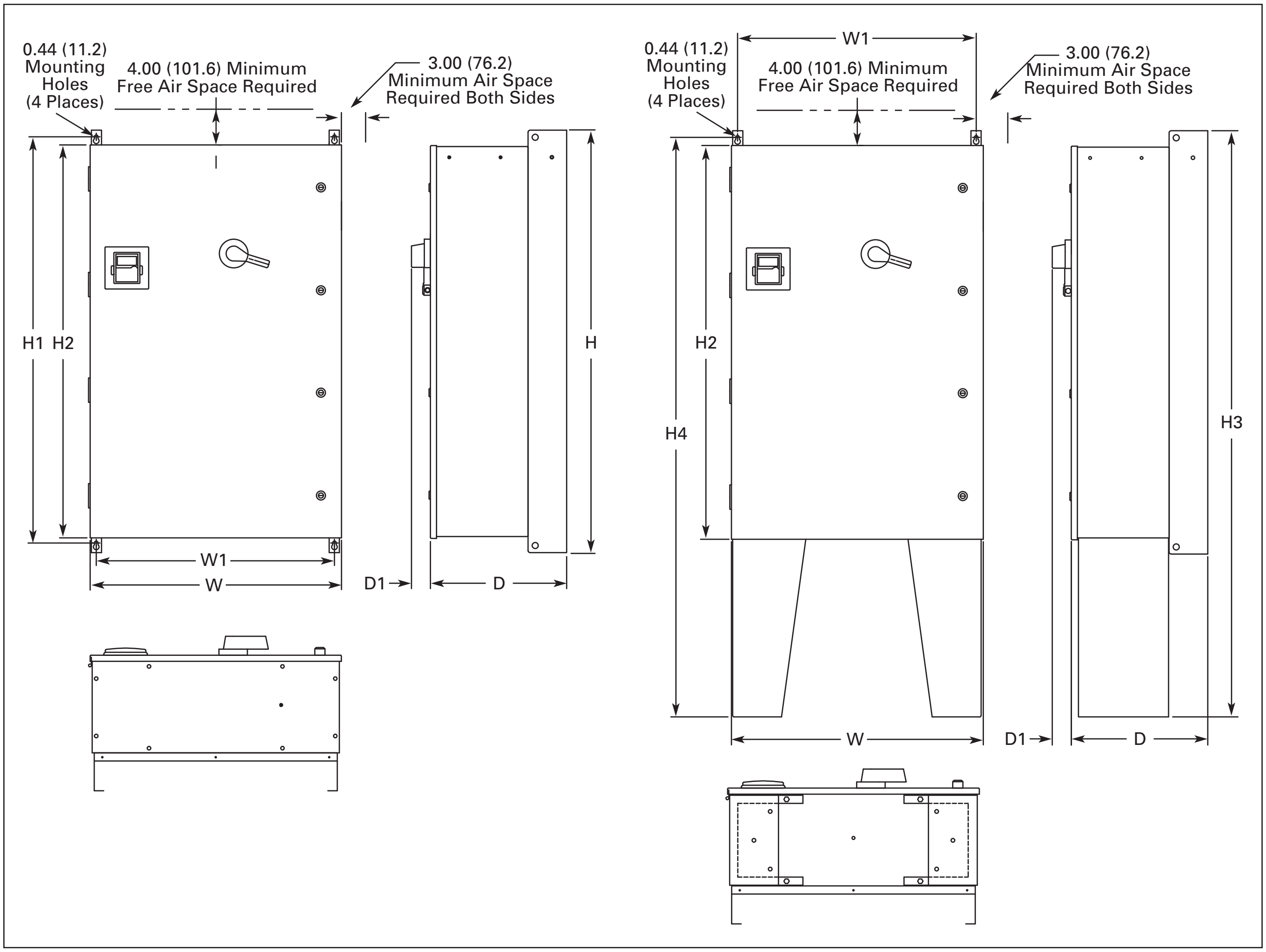


Figure 40-57. NEMA Type 12 SVX9000 Pump Application Drive Dimensions

Table 40-195. NEMA Type 12 SVX9000 Pump Application Drive Dimensions

Voltage AC	hp (I_H)	hp (I_L)	Approximate Dimensions in Inches (mm)									Approx. Ship Weight Lbs. (kg)
			H	H1	H2	H3	H4	W	W1	D	D1	
Three-Phase												
208V	30 – 50	40 – 60	52.00 (1320.8)	50.00 (1270.0)	48.35 (1228.1)	72.00 (1828.8)	71.19 (1808.2)	30.92 (785.4)	29.30 (744.2)	16.78 (426.2)	2.34 (59.4)	①
230V	30 – 50	40 – 60										
480V	75 – 125	100 – 150										
Single-Phase												
230V	—	25 – 40	52.00 (1320.8)	50.00 (1270.0)	48.35 (1228.1)	72.00 (1828.8)	71.19 (1808.2)	30.92 (785.4)	29.30 (744.2)	16.78 (426.2)	2.34 (59.4)	①
480V	—	40 – 60										

① Consult factory.

Enclosure Box A NEMA Type 3R

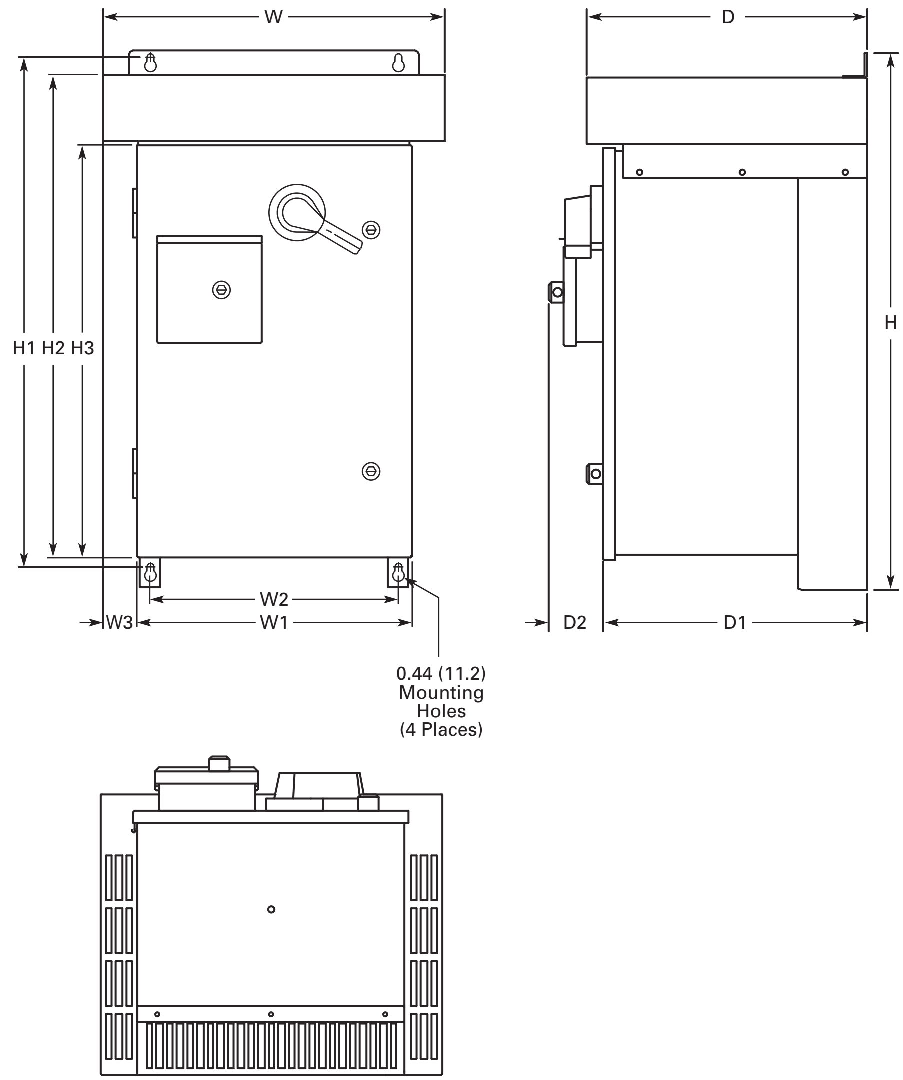


Figure 40-58. NEMA Type 3R SVX9000 Pump Application Drive Dimensions

Table 40-196. NEMA Type 3R SVX9000 Pump Application Drive Dimensions

Voltage AC	hp (I_H)	hp (I_L)	Approximate Dimensions in Inches (mm)											Approx. Weight Lbs. (kg)	Approx. Ship Weight Lbs. (kg)
			H	H1	H2	H3	W	W1	W2	W3	D	D1	D2		
Three-Phase															
208V	3/4 – 10	1 – 15	33.00 (838.2)	31.36 (796.5)	29.67 (753.6)	25.35 (643.9)	21.05 (534.7)	16.92 (429.8)	15.30 (388.6)	2.07 (52.6)	17.24 (437.9)	16.26 (413.0)	3.31 (84.1)	170 (77)	215 (98)
230V	3/4 – 10	1 – 15													
480V	1 – 25	1 – 30													
Single-Phase															
230V	—	3/4 – 10	33.00 (838.2)	31.36 (796.5)	29.67 (753.6)	25.35 (643.9)	21.05 (534.7)	16.92 (429.8)	15.30 (388.6)	2.07 (52.6)	17.24 (437.9)	16.26 (413.0)	3.31 (84.1)	170 (77)	215 (98)
480V	—	3/4 – 20													

Enclosure Box B NEMA Type 3R

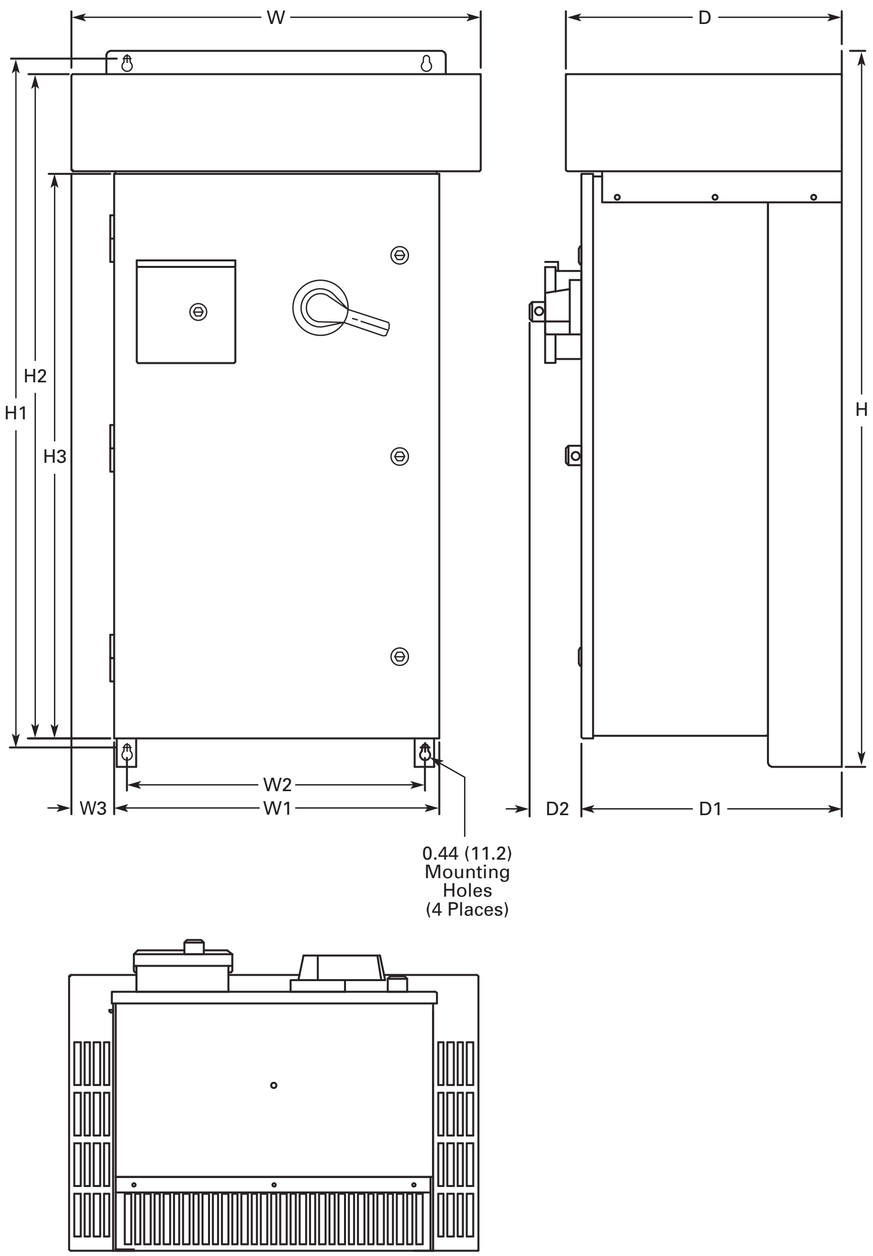


Figure 40-59. NEMA Type 3R SVX9000 Pump Application Drive Dimensions

Table 40-197. NEMA Type 3R SVX9000 Pump Application Drive Dimensions

Voltage AC	hp (I_H)	hp (I_L)	Approximate Dimensions in Inches (mm)											Approx. Weight Lbs. (kg)	Approx. Ship Weight Lbs. (kg)
			H	H1	H2	H3	W	W1	W2	W3	D	D1	D2		
Three-Phase															
208V	15 – 25	20 – 30	46.09 (1170.7)	44.45 (1129.0)	42.77 (1086.4)	36.35 (923.3)	26.31 (668.3)	20.92 (531.4)	19.30 (490.2)	2.69 (68.3)	17.74 (450.6)	16.76 (425.7)	3.31 (84.1)	235 (107)	290 (132)
230V	15 – 25	20 – 30													
480V	30 – 60	40 – 75													
Single-Phase															
230V	—	15 – 20	46.09 (1170.7)	44.45 (1129.0)	42.77 (1086.4)	36.35 (923.3)	26.31 (668.3)	20.92 (531.4)	19.30 (490.2)	2.69 (68.3)	17.74 (450.6)	16.76 (425.7)	3.31 (84.1)	235 (107)	290 (132)
480V	—	25 – 30													

Enclosure Type C NEMA Type 3R

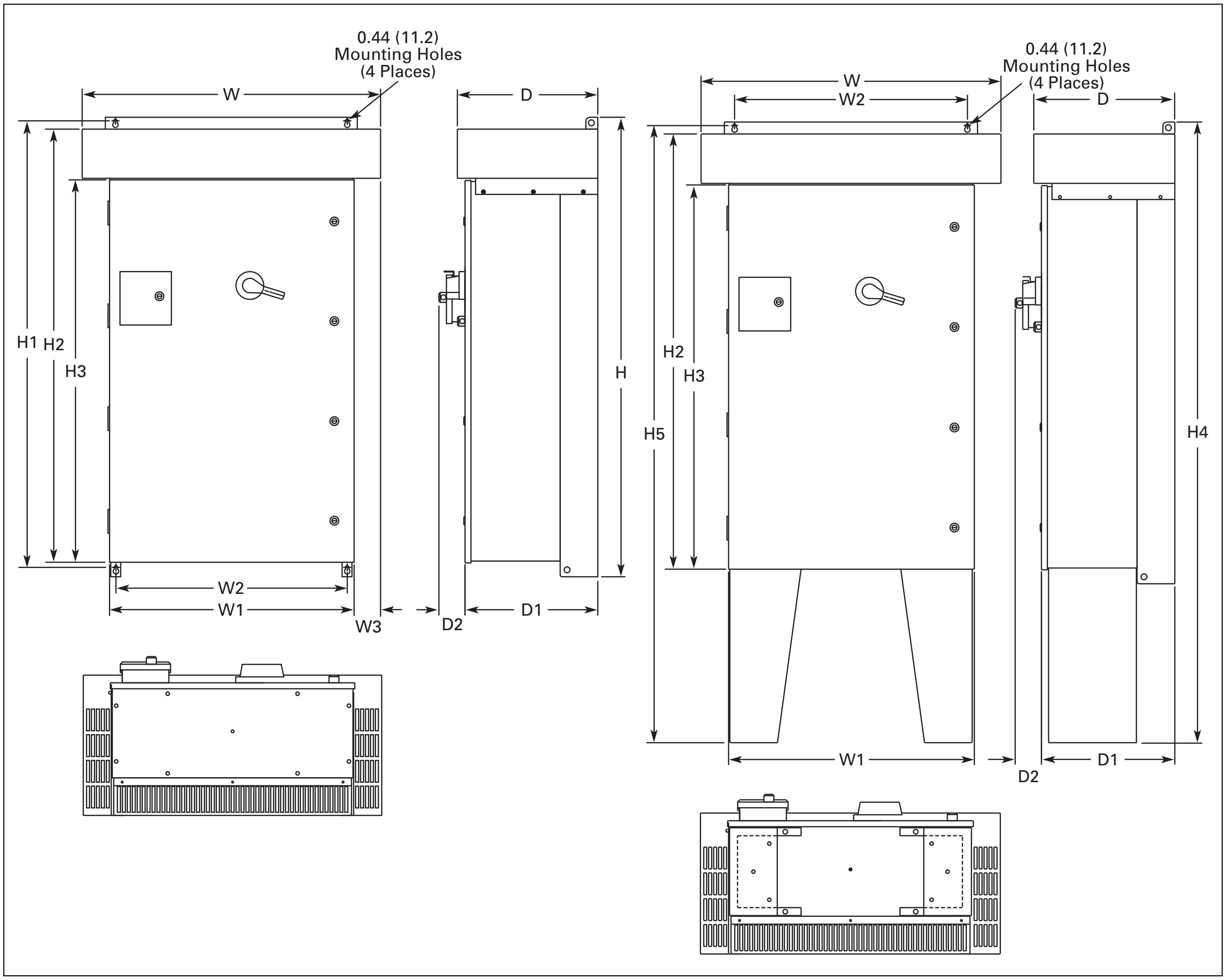


Figure 40-60. NEMA Type 3R SVX9000 Pump Application Drive Dimensions

Table 40-198. NEMA Type 3R SVX9000 Pump Application Drive Dimensions

Voltage AC	hp (I_H)	hp (I_L)	Approximate Dimensions in Inches (mm)													Approx. Weight Lbs. (kg)
			H	H1	H2	H3	H4	H5	W	W1	W2	W3	D	D1	D2	
Three-Phase																
208	30 – 50	40 – 60	58.09 (1475.5)	56.45 (1433.8)	54.77 (1391.2)	48.35 (1228.1)	78.09 (1983.5)	77.64 (1972.1)	37.73 (958.3)	30.92 (785.4)	29.30 (744.2)	3.34 (84.8)	17.74 (450.6)	16.77 (426.0)	3.31 (84.1)	①
230	30 – 50	40 – 60														
480	75 – 125	100 – 150														
Single-Phase																
230V	—	25 – 40	58.09 (1475.5)	56.45 (1433.8)	54.77 (1391.2)	48.35 (1228.1)	78.09 (1983.5)	77.64 (1972.1)	37.73 (958.3)	30.92 (785.4)	29.30 (744.2)	3.34 (84.8)	17.74 (450.6)	16.77 (426.0)	3.31 (84.1)	①
480V	—	40 – 60														

① Consult factory.

Wiring Diagrams

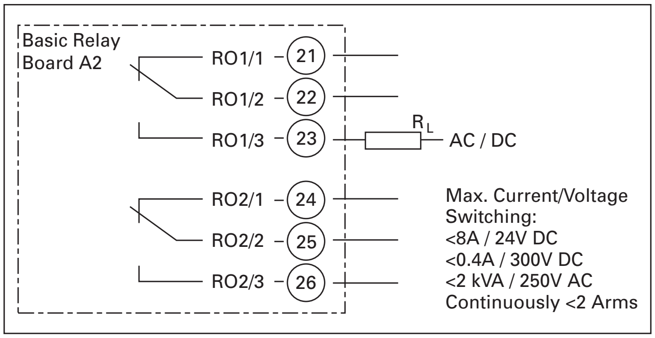


Figure 40-61. A2 Board Control Wiring

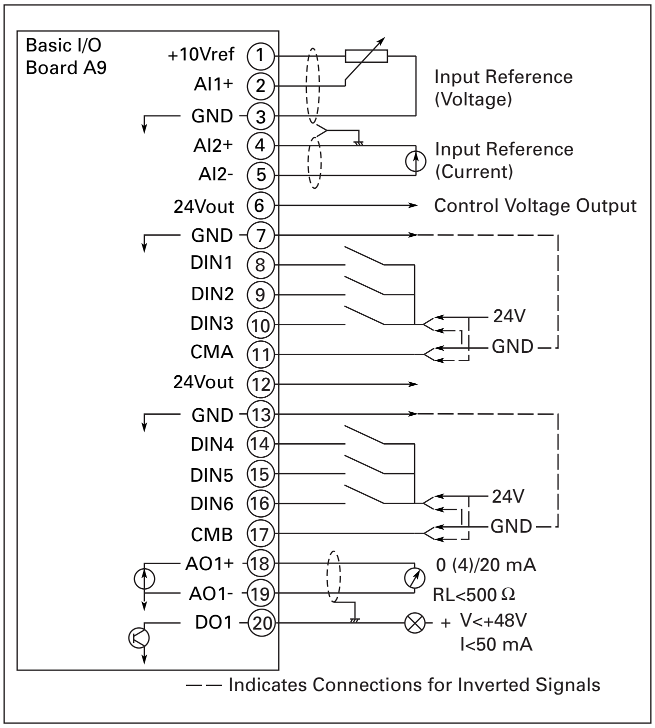


Figure 40-62. A9 Board Control Wiring

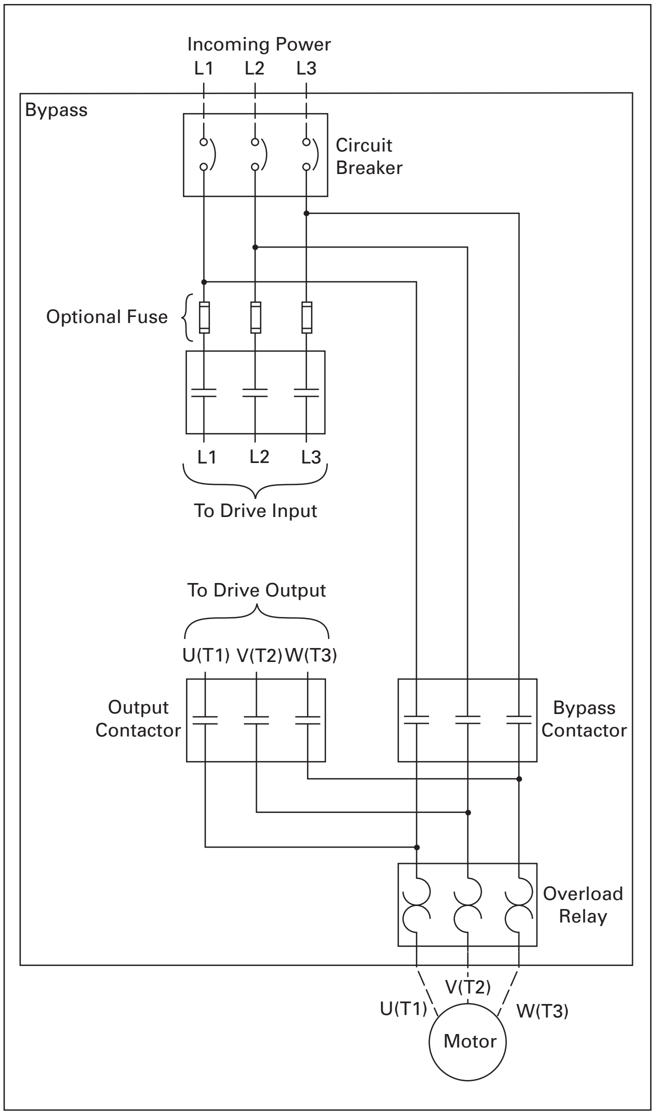


Figure 40-63. SVX9000 Pump Panel Bypass Power Wiring

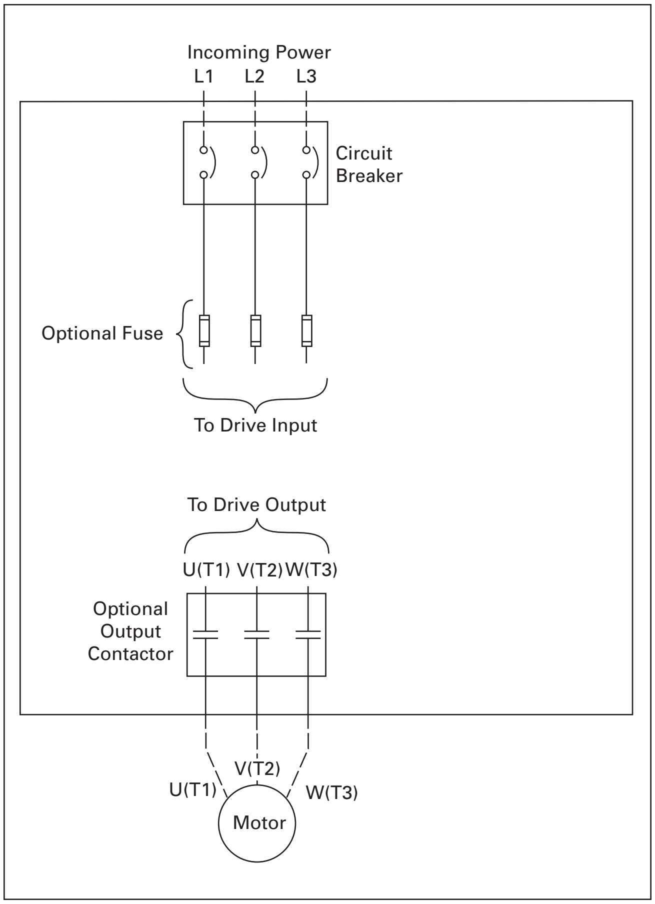


Figure 40-64. SVX9000 Pump Panel Disconnect Power Wiring

June 2008

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SPX9000 Drives



SPX9000 Drives

Product Description

The Cutler-Hammer® SPX9000 Series Adjustable Frequency Drives from Eaton's electrical business are specifically designed for high performance applications. Equipped with high processing power, the SPX9000 can use information from an encoder or a resolver in order to provide very precise motor control. Sensorless vector and simple frequency control are also supported. Typical applications requiring high performance are: master-slave drives, positioning applications, winder tension control and synchronization.

The core of the SPX9000 is a fast microprocessor, providing high dynamic performance for applications where good motor handling and reliability are required. It can be used both in open loop applications as well as in applications requiring encoder feedback.

The SPX9000 supports fast drive-to-drive communication. It also offers an integrated data logger functionality for analysis of dynamic events without the need of additional hardware. Simultaneous fast monitoring of several drives can be done by using the 9000Xdrive tool and CAN communication. In applications where reliability and quality are essential for high-performance, the Cutler-Hammer SPX9000 is the logical choice.

The 9000X Family of Drives includes HVX9000, SVX9000, SLX9000 and SPX9000. 9000X Series drive ratings are rated for either high overload (I_H) or low overload (I_L). I_L indicates 110% overload capacity for 1 minute out of 10 minutes. I_H indicates 150% overload capacity for 1 minute out of 10 minutes.

Features and Benefits

- Speed error < 0.01%, depending on the encoder
- Incremental or absolute encoder support
- Encoder voltages of 5V (RS-422), 15V or 24V, depending on the option card
- Full torque control at all speeds, including zero
- Torque accuracy < 2%; < 5% down to zero speed
- Starting torque > 200%, depending on motor and drive sizing
- Integrated datalogger for system analysis
- Fast multiple drive monitoring with PC
- Full capability for master/slave configurations
- High-speed bus (12 Mbit/s) for fast inter-drive communication
- High-speed applications (up to 7200 Hz) possible
- Robust design — proven 500,000 hours MTBF
- Integrated 3% line reactors standard on drives from FR4 through FR9
- Line reactor is included but is separated from chassis
- EMI/RFI Filters H standard up to 200 hp I_H 480V, 100 hp I_H 230V
- Simplified operating menu allows for typical programming changes, while programming mode provides control of everything
- Quick Start Wizard built into the programming of the drive ensures a smooth start-up
- Keypad can display up to three monitored parameters simultaneously
- LOCAL/REMOTE operation from keypad
- Copy/Paste function allows transfer of parameter settings from one drive to the next
- Standard NEMA Type 12 keypad on all drives
- Hand-Held Auxiliary 240 Power Supply allows programming/monitoring of control module without applying full power to the drive
- The SPX can be flexibly adapted to a variety of needs using our pre-installed "Seven in One" Precision application programs consisting of:
  - ❑ Basic
  - ❑ Standard
  - ❑ Local/Remote
  - ❑ Multi Step Speed Control
  - ❑ PID Control
  - ❑ Multi-Purpose Control
  - ❑ Pump and Fan Control with Auto Change
- Additional I/O and communication cards provide plug and play functionality
- I/O connections with simple quick connection terminals
- UL Listed
- Control logic can be powered from an external auxiliary control panel, internal drive functions and fieldbus if necessary
- Brake Chopper standard from:
  1 – 30 hp/380 – 500V
  3/4 – 15 hp/208 – 230V
- NEMA Type 1 enclosures available Frame Sizes FR4 – FR11, NEMA Type 12 enclosures available Frame Sizes FR4 – FR10 (FR10 and FR11 Free-standing Drives)
- Open Chassis FR10 and greater
- Standard option board configuration includes an A9 I/O board and an A2 relay output board installed in slots A and B

Technical Data and Specifications

Table 40-199. SPX9000 Specifications

Description	Specification
Input Ratings	
Input Voltage (V_{in})	+10% / -15%
Input Frequency (f_{in})	50/60 Hz (variation up to 45 – 66 Hz)
Connection to Power	Once per minute or less (typical operation)
High Withstand Rating	100 kAIC
Output Ratings	
Output Voltage	0 to V_{in}
Continuous Output Current	I_H rated 100% at 122°F (50°C), FR9 and below I_L rated 100% at 104°F (40°C), FR9 and below I_H/I_L 100% at 104°F (40°C), FR10 and above
Overload Current (I_H/I_L)	150% I_H, 110% I_L for 1 min.
Output Frequency	0 to 320 Hz
Frequency Resolution	.01 Hz
Initial Output Current (I_H)	250% for 2 seconds
Control Characteristics	
Control Method	Frequency Control (V/f) Open Loop Sensorless Vector Control Closed Loop Frequency Control Closed Loop Vector Control
Switching Frequency Frame 4 – 6 Frame 7 – 12	Adjustable with Parameter 2.6.9 1 to 16 kHz; default 10 kHz 1 to 10 kHz; default 3.6 kHz
Frequency Reference	Analog Input: Resolution .1% (10-bit), accuracy ± 1% V/Hz Panel Reference: Resolution .01 Hz
Field Weakening Point	30 to 320 Hz
Acceleration Time	0 to 3000 sec.
Deceleration Time	0 to 3000 sec.
Braking Torque	DC brake: 30% x T_n (without brake option)
Ambient Conditions	
Ambient Operating Temperature	14°F (-10°C), no frost to 122°F (+50°C) I_H (FR4 – FR9) 14°F (-10°C), no frost to 104°F (+40°C) I_L (FR10 and up) 14°F (-10°C), no frost to 104°F (+40°C) I_L (All Frames)
Storage Temperature	-40°F (-40°C) to 158°F (70°C)
Relative Humidity	0 to 95% RH, noncondensing, non-corrosive, no dripping water
Air Quality	Chemical vapors: IEC 721-3-3, unit in operation, class 3C2; Mechanical particles: IEC 721-3-3, unit in operation, class 3S2
Altitude	100% load capacity (no derating) up to 3280 ft. (1000m); 1% derating for each 328 ft. (100m) above 3280 ft. (1000m); max. 9842 ft. (3000m)
Vibration	EN 50178, EN 60068-2-6; 5 to 50 Hz, Displacement amplitude 1 mm (peak) at 3 to 15.8 Hz, Max. acceleration amplitude 1G at 15.8 to 150 Hz
Shock	EN 50178, EN 60068-2-27 UPS Drop test (for applicable UPS weights) Storage and shipping: max. 15G, 11 ms (in package)
Enclosure Class	NEMA 1/IP21 or NEMA 12/IP54, Open Chassis/IP20

Description	Specification
Standards	
Product	IEC 61800-2
Safety	UL 508C
EMC (at default settings)	Immunity: Fulfills all EMC immunity requirements; Emissions: EN 61800-3, LEVEL H
Control Connections	
Analog Input Voltage	0 to 10V, R = 200 kΩ (-10 to 10V joystick control) Resolution .1%; accuracy ±1%
Analog Input Current	0(4) to 20 mA; R_i - 250Ω differential
Digital Inputs (6)	Positive or negative logic; 18 to 30V DC
Auxiliary Voltage	+24V ±15%, max. 250 mA
Output Reference Voltage	+10V +3%, max. load 10 mA
Analog Output	0(4) to 20 mA; R_L max. 500Ω; Resolution 10 bit; Accuracy ±2%
Digital Outputs	Open collector output, 50 mA/48V
Relay Outputs	2 programmable Form C relay outputs Switching capacity: 24V DC / 8A, 250V AC / 8A, 125V DC / .4A
Protections	
Overcurrent Protection	Trip limit 4.0 x I_H instantaneously
Overvoltage Protection	Yes
Undervoltage Protection	Yes
Earth Fault Protection	In case of earth fault in motor or motor cable, only the frequency converter is protected
Input Phase Supervision	Trips if any of the input phases are missing
Motor Phase Supervision	Trips if any of the output phases are missing
Overtemperature Protection	Yes
Motor Overload Protection	Yes
Motor Stall Protection	Yes
Motor Underload Protection	Yes
Short Circuit Protection	Yes (+24V and +10V Reference Voltages)
High Performance Features	
Speed Error	<0.01%, depending on the encoder
Encoder Support	Incremental or absolute
Encoder Voltages	5V (RS-422), 15V or 24V, depending on the option card
Torque Control	Full torque control at all speeds, including zero
Torque Accuracy	<2%; <5% down to zero speed
Starting Torque	>200%, depending on motor and drive sizing
Master/Slave Configurations	Full capability
System Analysis	Integrated data logger
PC Communication	Fast multiple drive monitoring with PC
Inter-Drive Communication	High-speed bus (12 Mbits/s)
High-Speed Applications	Up to 7200 Hz

Catalog Number Selection

Table 40-200. Adjustable Frequency Drive Catalog Numbering System

SPX 010 A 1 – 4 A 1 B 1 _ _ _ _ _ _

Product Family
SPX = Open Drives

Horsepower Rating	
F07 = 3/4	**125** = 125
001 = 1	**150** = 150
F15 = 1-1/2	**250** = 250
002 = 2	**300** = 300
003 = 3	**350** = 350
004 = 5 (I_L)	**400** = 400
005 = 5	**500** = 500
006 = 7-1/2 (I_L)	**550** = 550
007 = 7-1/2	**600** = 600
010 = 10	**650** = 650
015 = 15	**700** = 700
020 = 20	**800** = 800
025 = 25	**900** = 900
030 = 30	**H10** = 1000
040 = 40	**H12** = 1200
050 = 50	**H13** = 1350
060 = 60	**H15** = 1500
075 = 75	**H16** = 1600
100 = 100	**H20** = 2000

AFD Software Series
A = Standard Software

Enclosure ③
0 = Chassis
1 = NEMA Type 1
2 = NEMA Type 12

Voltage Rating
2 = 230 (208 – 240) V
4 = 480 (380 – 500) V
5 = 575 (525 – 690) V

Keypad
A = Alphanumeric

Input Options ①
1 = 3-phase, EMC H
2 = 3-phase, EMC N
4 = 3-phase, EMC L

Brake Chopper Options ②
N = No Brake Chopper Circuit
B = Internal Brake Chopper Circuit

Board Modifications
1 = Standard Boards
2 = Conformal (Varnished) Coating ④

Options
Options appear in alphabetical order.
Extended I/O Card Options
A3 = 2 RO, Therm
A4 = Encoder low volt +5V/15V24V
A5 = Encoder high volt +15V/24V
A7 = Double Encoder
A8 = 6 DI, 1 DO, 2 AI, 1AO
AE = 3 DI (Encoder 10 – 24V), Out +15V/+24V 2 DO (pulse + direction)
B1 = 6 DI, 1 ext +24V DC/EXT +24V DC
B2 = 1 RO (NC/NO), 1 RO (NO), 1 Therm
B4 = 1 AI (mA isolated), 2 AO (mA isolated), 1 ext +24V DC/EXT + 24V DC
B5 = 3 RO (NO)
B8 = 1 ext +24V DC/EXT +24V DC, 3 Pt100
B9 = 1 RO (NO), 5 DI 42 – 240V AC Input
BB = SPI, Absolute Encoder
Communication Cards
CA = Johnson Controls N2
CI = Modbus TCP
CJ = BACnet
CK = Ethernet IP
C2 = Modbus
C3 = Profibus DP
C4 = LonWorks
C5 = Profibus DP (D9 Connector)
C6 = CANopen (Slave)
C7 = DeviceNet
C8 = Modbus (D9 Type Connector)
D1 = Adapter — SPX Only
D2 = Adapter — SPX Only
D3 = RS-232 with D9 Connection

① All 230V Drives and 480V Drives up to 200 hp (I_H) are only available with Input Option **1** (EMC level H). 480V Drives 250 hp (I_H) or larger are available with Input Option **2** (EMC level N). 575V Drives 200 hp (I_H) or larger are available with Input Option **2**. 575V Drives up to 150 hp (I_H) are available with Input Option **4** (EMC level L). 480V and 690V Freestanding Drives are available with Input Option **4** (EMC level L).

② 480V Drives up to 30 hp (I_H) are only available with Brake Chopper Option **B**. 480V Drives 40 hp (I_H) or larger come standard with Brake Chopper Option **N**. 230V Drives up to 15 hp (I_H) are only available with Brake Chopper Option **B**. 230V Drives 20 hp and larger come standard with Brake Chopper Option **N**. All 575V Drives come standard without Brake Chopper Option (**N**). Note: N = No Brake Chopper.

③ 480V Drives 250 – 350 hp (I_H) and 690V Drives 200 – 300 hp (I_H) are available with enclosure style **0** (Chassis). 480V and 690V FR10 Freestanding Drives are available with **1** (NEMA Type 1) or **2** (NEMA Type 12). FR11 Freestanding Drives are only available with enclosure style **1** (NEMA Type 1).

④ Factory promise delivery. Consult Sales Office for availability.

Product Selection

230V SPX9000 Drives

Table 40-201. 208 – 240V, NEMA Type 1 Drive

Frame Size	Delivery Code	hp (I_H)	Current (I_H)	hp (I_L)	Current (I_L)	Catalog Number	Price U.S. $
FR4	FP	3/4 1 1-1/2 2 3	3.7 4.8 6.6 7.8 11	1 1-1/2 2 3 —	4.8 6.6 7.8 11 12.5	**SPXF07A1-2A1B1** **SPX001A1-2A1B1** **SPXF15A1-2A1B1** **SPX002A1-2A1B1** **SPX003A1-2A1B1**	
FR5	FP	— 5 7-1/2	12.5 17.5 25	5 7-1/2 10	17.5 25 31	**SPX004A1-2A1B1** **SPX005A1-2A1B1** **SPX007A1-2A1B1**	
FR6	FP	10 15	31 48	15 20	48 61	**SPX010A1-2A1B1** **SPX015A1-2A1B1**	
FR7	FP	20 25 30	61 75 88	25 30 40	75 88 114	**SPX020A1-2A1N1** **SPX025A1-2A1N1** **SPX030A1-2A1N1**	
FR8	FP	40 50 60	114 140 170	50 60 75	140 170 205	**SPX040A1-2A1N1** **SPX050A1-2A1N1** **SPX060A1-2A1N1**	
FR9	FP	75 100	205 261	100 —	261 —	**SPX075A1-2A1N1** **SPX100A1-2A1N1**	

Table 40-202. 208 – 240V, NEMA Type 12 Drive

Frame Size	Delivery Code	hp (I_H)	Current (I_H)	hp (I_L)	Current (I_L)	Catalog Number	Price U.S. $
FR4	FP	3/4 1 1-1/2 2 3	3.7 4.8 6.6 7.8 11	1 1-1/2 2 3 —	4.8 6.6 7.8 11 12.5	**SPXF07A2-2A1B1** **SPX001A2-2A1B1** **SPXF15A2-2A1B1** **SPX002A2-2A1B1** **SPX003A2-2A1B1**	
FR5	FP	— 5 7-1/2	12.5 17.5 25	5 7-1/2 10	17.5 25 31	**SPX004A2-2A1B1** **SPX005A2-2A1B1** **SPX007A2-2A1B1**	
FR6	FP	10 15	31 48	15 20	48 61	**SPX010A2-2A1B1** **SPX015A2-2A1B1**	
FR7	FP	20 25 30	61 75 88	25 30 40	75 88 114	**SPX020A2-2A1N1** **SPX025A2-2A1N1** **SPX030A2-2A1N1**	
FR8	FP	40 50 60	114 140 170	50 60 75	140 170 205	**SPX040A2-2A1N1** **SPX050A2-2A1N1** **SPX060A2-2A1N1**	
FR9	FP	75 100	205 261	100 —	261 —	**SPX075A2-2A1N1** **SPX100A2-2A1N1**	

Discount Symbol **SS-2**

480V SPX9000 Drives

Table 40-203. 380 – 500V, NEMA Type 1 Drive

Frame Size	Delivery Code	hp (I_H)	Current (I_H)	hp (I_L)	Current (I_L)	Catalog Number	Price U.S. $
FR4	W	1	2.2	1-1/2	3.3	**SPX001A1-4A1B1**	
	FP	1-1/2	3.3	2	4.3	**SPXF15A1-4A1B1**	
	FP	2	4.3	3	5.6	**SPX002A1-4A1B1**	
	W	3	5.6	5	7.6	**SPX003A1-4A1B1**	
	W	5	7.6	—	9	**SPX005A1-4A1B1**	
	FP	—	9	7-1/2	12	**SPX006A1-4A1B1**	
FR5	W	7-1/2	12	10	16	**SPX007A1-4A1B1**	
		10	16	15	23	**SPX010A1-4A1B1**	
		15	23	20	31	**SPX015A1-4A1B1**	
FR6	W	20	31	25	38	**SPX020A1-4A1B1**	
		25	38	30	46	**SPX025A1-4A1B1**	
		30	46	40	61	**SPX030A1-4A1B1**	
FR7	FP	40	61	50	72	**SPX040A1-4A1N1**	
	W	50	72	60	87	**SPX050A1-4A1N1**	
	W	60	87	75	105	**SPX060A1-4A1N1**	
FR8	FP	75	105	100	140	**SPX075A1-4A1N1**	
	W	100	140	125	170	**SPX100A1-4A1N1**	
	W	125	170	150	205	**SPX125A1-4A1N1**	
FR9	W	150	205	200	261	**SPX150A1-4A1N1**	
		200	245	250	300	**SPX200A1-4A1N1**	

Table 40-204. 380 – 500V, NEMA Type 1 Freestanding Drive

Frame Size	Delivery Code	hp (I_H)	Current (I_H)	hp (I_L)	Current (I_L)	Catalog Number	Price U.S. $
FR10	W	250	330	300	385	**SPX250A1-4A4N1**	
	FP	300	385	350	460	**SPX300A1-4A4N1**	
	W	350	460	400	520	**SPX350A1-4A4N1**	
FR11	FP	400	520	500	590	**SPX400A1-4A4N1**	
	FP	500	590	550	650	**SPX500A1-4A4N1**	
	FP	550	650	600	730	**SPX550A1-4A4N1**	

Note: Integrated fuses as standard. Limited option selection available; 115V Transformer (KB), Light Kit (L1), HOA (K4), Speed Potentiometer w/HOA (K2), Disconnect Switch (P2). See Free-standing Option selection on **Page 40-143**.

Table 40-205. 380 – 500V, NEMA Type 12 Drive

Frame Size	Delivery Code	hp (I_H)	Current (I_H)	hp (I_L)	Current (I_L)	Catalog Number	Price U.S. $
FR4	W	1	2.2	1-1/2	3.3	**SPX001A2-4A1B1**	
	FP	1-1/2	3.3	2	4.3	**SPXF15A2-4A1B1**	
	FP	2	4.3	3	5.6	**SPX002A2-4A1B1**	
	W	3	5.6	5	7.6	**SPX003A2-4A1B1**	
	W	5	7.6	—	9	**SPX005A2-4A1B1**	
	FP	—	9	7-1/2	12	**SPX006A2-4A1B1**	
FR5	W	7-1/2	12	10	16	**SPX007A2-4A1B1**	
		10	16	15	23	**SPX010A2-4A1B1**	
		15	23	20	31	**SPX015A2-4A1B1**	
FR6	W	20	31	25	38	**SPX020A2-4A1B1**	
		25	38	30	46	**SPX025A2-4A1B1**	
		30	46	40	61	**SPX030A2-4A1B1**	
FR7	FP	40	61	50	72	**SPX040A2-4A1N1**	
		50	72	60	87	**SPX050A2-4A1N1**	
		60	87	75	105	**SPX060A2-4A1N1**	
FR8	FP	75	105	100	140	**SPX075A2-4A2N1**	
		100	140	125	170	**SPX100A2-4A1N1**	
		125	170	150	205	**SPX125A2-4A1N1**	
FR9	FP	150	205	200	261	**SPX150A2-4A1N1**	
		200	245	250	300	**SPX200A2-4A1N1**	

Discount Symbol **SS-2**

Table 40-206. 380 – 500V, NEMA Type 12 Freestanding Drive

Frame Size	Delivery Code	hp (I_H)	Current (I_H)	hp (I_L)	Current (I_L)	Catalog Number	Price U.S. $
FR10	FP FP FP	250 300 350	330 385 460	300 350 400	385 460 520	**SPX250A2-4A4N1** **SPX300A2-4A4N1** **SPX350A2-4A4N1**	

Note: Integrated fuses as standard. Limited option selection available; 115V Transformer (KB), Light Kit (L1), HOA (K4), Speed Potentiometer w/HOA (K2), Disconnect Switch (P2). See Freestanding Option selection on **Page 40-143**.

Table 40-207. 480V 380 – 500, Open Chassis Drive

Frame Size ①	Delivery Code	hp (I_H)	Current (I_H)	hp (I_L)	Current (I_L)	Catalog Number	Price U.S. $
FR10	W	250 300 350	330 385 460	300 — 400	385 460 520	**SPX250A0-4A2N1** **SPX300A0-4A2N1** **SPX350A0-4A2N1**	
FR11	FP	400 500 —	520 590 650	500 — 600	590 650 730	**SPX400A0-4A2N1** **SPX500A0-4A2N1** **SPX550A0-4A2N1**	
FR12	FP	600 — 700	730 820 920	— 700 800	820 920 1030	**SPX600A0-4A2N1** **SPX650A0-4A2N1** **SPX700A0-4A2N1**	
FR13	FP	800 900 1000	1030 1150 1300	900 1000 1200	1150 1300 1450	**SPX800A0-4A2N1** **SPX900A0-4A2N1** **SPXH10A0-4A2N1**	
FR14	FP	1200 1600	1600 1940	1500 1800	1770 2150	**SPXH12A0-4A2N1** **SPXH16A0-4A2N1**	

① FR10 – FR14 includes 3% line reactor, but it is not integral to chassis.

575V SPX9000 Drives

Table 40-208. 525 – 690V, NEMA Type 1 Drive

Frame Size	Delivery Code	hp (I_H)	Current (I_H)	hp (I_L)	Current (I_L)	Catalog Number	Price U.S. $
FR6	W	2 3 — 5 7-1/2 10 15 20 25	3.33 4.5 5.5 7.5 10 13.5 18 22 27	3 — 5 7-1/2 10 15 20 25 30	4.5 5.5 7.5 10 13.5 18 22 27 34	**SPX002A1-5A4N1** **SPX003A1-5A4N1** **SPX004A1-5A4N1** **SPX005A1-5A4N1** **SPX007A1-5A4N1** **SPX010A1-5A4N1** **SPX015A1-5A4N1** **SPX020A1-5A4N1** **SPX025A1-5A4N1**	
FR7	W	30 40	34 41	40 50	41 52	**SPX030A1-5A4N1** **SPX040A1-5A4N1**	
FR8	W	50 60 75	52 62 80	60 75 100	62 80 100	**SPX050A1-5A4N1** **SPX060A1-5A4N1** **SPX075A1-5A4N1**	
FR9	W	100 125 150 —	100 125 144 170	125 150 — 200	125 144 170 208	**SPX100A1-5A4N1** **SPX125A1-5A4N1** **SPX150A1-5A4N1** **SPX175A1-5A4N1**	

Table 40-209. 525 – 690V, NEMA Type 1 Freestanding Drive

Frame Size	Delivery Code	hp (I_H)	Current (I_H)	hp (I_L)	Current (I_L)	Catalog Number	Price U.S. $
FR10	FP	200 250 300	208 261 325	250 300 400	261 325 385	**SPX200A1-5A4N1** **SPX250A1-5A4N1** **SPX300A1-5A4N1**	
FR11	FP	400 450 500	385 460 502	450 500 550	460 502 590	**SPX400A1-5A4N1** **SPX450A1-5A4N1** **SPX500A1-5A4N1**	

Note: Integrated fuses as standard. Limited option selection available; 115V Transformer (KB), Light Kit (L1), HOA (K4), Speed Potentiometer w/HOA (K2), Disconnect Switch (P2). See Freestanding Option selection on **Page 40-143**.

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Discount Symbol **SS-2**

Table 40-210. 525 – 690V, NEMA Type 12 Drive

Frame Size	Delivery Code	hp (I_H)	Current (I_H)	hp (I_L)	Current (I_L)	Catalog Number	Price U.S. $
FR6	F1	2	3.33	3	4.5	**SPX002A2-5A4N1**	
		3	4.5	—	5.5	**SPX003A2-5A4N1**	
		—	5.5	5	7.5	**SPX004A2-5A4N1**	
		5	7.5	7-1/2	10	**SPX005A2-5A4N1**	
		7-1/2	10	10	13.5	**SPX007A2-5A4N1**	
		10	13.5	15	18	**SPX010A2-5A4N1**	
		15	18	20	22	**SPX015A2-5A4N1**	
		20	22	25	27	**SPX020A2-5A4N1**	
		25	27	30	34	**SPX025A2-5A4N1**	
FR7	FP	30	34	40	41	**SPX030A2-5A4N1**	
		40	41	50	52	**SPX040A2-5A4N1**	
FR8	FP	50	52	60	62	**SPX050A2-5A4N1**	
		60	62	75	80	**SPX060A2-5A4N1**	
		75	80	100	100	**SPX075A2-5A4N1**	
FR9	FP	100	100	125	125	**SPX100A2-5A4N1**	
		125	125	150	144	**SPX125A2-5A4N1**	
		150	144	—	170	**SPX150A2-5A4N1**	
		—	170	200	208	**SPX175A2-5A4N1**	

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Table 40-211. 525 – 690V, NEMA Type 12 Freestanding Drive

Frame Size	Delivery Code	hp (I_H)	Current (I_H)	hp (I_L)	Current (I_L)	Catalog Number	Price U.S. $
FR10	FP	200	208	250	261	**SPX200A2-5A4N1**	
		250	261	300	325	**SPX250A2-5A4N1**	
		300	325	400	385	**SPX300A2-5A4N1**	

Note: Integrated fuses as standard. Limited option selection available; 115V Transformer (KB), Light Kit (L1), HOA (K4), Speed Potentiometer w/HOA (K2), Disconnect Switch (P2). See Free-standing Option selection on **Page 40-143**.

Table 40-212. 525 – 690V, Open Chassis Drive

Frame Size ①	Delivery Code	hp (I_H)	Current (I_H)	hp (I_L)	Current (I_L)	Catalog Number	Price U.S. $
FR10	FP	200	208	250	261	**SPX200A0-5A2N1**	
		250	261	300	325	**SPX250A0-5A2N1**	
		300	325	400	385	**SPX300A0-5A2N1**	
FR11	FP	400	385	450	460	**SPX400A0-5A2N1**	
		450	460	500	502	**SPX450A0-5A2N1**	
		500	502	—	590	**SPX500A0-5A2N1**	
FR12	FP	—	590	600	650	**SPX550A0-5A2N1**	
		600	650	700	750	**SPX600A0-5A2N1**	
		700	750	800	820	**SPX700A0-5A2N1**	
FR13	FP	800	820	900	920	**SPX800A0-5A2N1**	
		900	920	1000	1030	**SPX900A0-5A2N1**	
		1000	1030	1250	1180	**SPXH10A0-5A2N1**	
FR14	FP	1350	1300	1500	1500	**SPXH13A0-5A2N1**	
		1500	1500	2000	1900	**SPXH15A0-5A2N1**	
		2000	1900	2300	2250	**SPXH20A0-5A2N1**	

① FR10 – FR14 includes a 3% line reactor but it is not integral to chassis.

Discount Symbol **SS-2**

Series Option Board Kits

The 9000X Series drives can accommodate a wide selection of expander and adapter option boards to customize the drive for your application needs. The drive's control unit is designed to accept a total of five option boards (see **Figure 40-65**).

The 9000X Series factory installed standard board configuration includes an A9 I/O board and an A2 relay output board, which are installed in slots A and B.

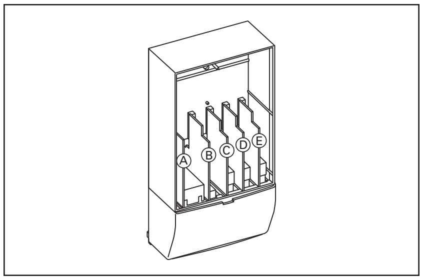


Figure 40-65. 9000X Series Option Boards

Table 40-213. Option Board Kits

Option Kit Description ②	Allowed Slot Locations ①	Field Installed		Factory Installed		SVX Ready Programs						
		Catalog Number	Price U.S.$	Option Designator	Adder U.S.$	Basic	Local/ Remote	Standard	MSS	PID	Multi-P.	PFC
Standard I/O Cards (See Figure 40-65)												
2 RO (NC/NO)	B	**OPTA2**		**—**		X	X	X	X	X	X	X
6 DI, 1 DO, 2 AI, 1AO, 1 +10V DC ref, 2 ext +24V DC/ EXT +24V DC	A	**OPTA9**		**—**		X	X	X	X	X	X	X
Extended I/O Card Options												
2 RO, Therm	B	**OPTA3**		**A3**		—	X	X	X	X	X	X
Encoder low volt +5V/15V24V	C	**OPTA4**		**A4**		—	X	X	X	X	X	X
Encoder high volt +15V/24V	C	**OPTA5**		**A5**		—	X	X	X	X	X	X
Double encoder — SPX Only	C	**OPTA7**		**A7**		X	X	X	X	X	X	X
6 DI, 1 DO, 2 AI, 1 AO	A	**OPTA8**		**A8**		—	X	X	X	X	X	X
3 DI (Encoder 10 – 24V), Out +15V/+24V, 2 DO (pulse+direction) — SPX Only	C	**OPTAE**		**AE**		X	X	X	X	X	X	X
6 DI, 1 ext +24V DC/EXT +24V DC	B, C, **D**, E	**OPTB1**		**B1**		—	—	—	—	—	X	X
1 RO (NC/NO), 1 RO (NO), 1 Therm	B, C, **D**, E	**OPTB2**		**B2**		—	—	—	—	—	X	X
1 AI (mA isolated), 2 AO (mA isolated), 1 ext +24V DC/EXT +24V DC	B, C, **D**, E	**OPTB4**		**B4**		—	X	X	X	X	X	X
3 RO (NO)	B, C, **D**, E	**OPTB5**		**B5**		—	—	—	—	—	X	X
1 ext +24V DC/EXT +24V DC, 3 Pt100	B, C, **D**, E	**OPTB8**		**B8**		—	—	—	—	—	—	—
1 RO (NO), 5 DI 42 – 240V AC Input	B,C, **D**, E	**OPTB9**		**B9**		—	—	—	—	—	X	X
SPI, Absolute Encoder	C	**OPTBB**		**BB**		—	—	—	—	—	—	—
Communication Cards ③												
Modbus	D, **E**	**OPTC2**		**C2**		X	X	X	X	X	X	X
Johnson Controls N2	D, **E**	**OPTC2**		**CA**		—	—	—	—	—	—	—
Modbus TCP	D, **E**	**OPTCI**		**CI**		X	X	X	X	X	X	X
BACnet	D, **E**	**OPTCJ**		**CJ**		X	X	X	X	X	X	X
Ethernet IP	D, **E**	**OPTCK**		**CK**		X	X	X	X	X	X	X
Profibus DP	D, **E**	**OPTC3**		**C3**		X	X	X	X	X	X	X
LonWorks	D, **E**	**OPTC4**		**C4**		X	X	X	X	X	X	X
Profibus DP (D9 Connector)	D, **E**	**OPTC5**		**C5**		X	X	X	X	X	X	X
CanOpen (Slave)	D, **E**	**OPTC6**		**C6**		X	X	X	X	X	X	X
DeviceNet	D, **E**	**OPTC7**		**C7**		X	X	X	X	X	X	X
Modbus (D9 Type Connector)	D, **E**	**OPTC8**		**C8**		X	X	X	X	X	X	X
Adapter — SPX Only	D, **E**	**OPTD1**		**D1**		X	X	X	X	X	X	X
Adapter — SPX Only	D, **E**	**OPTD2**		**D2**		X	X	X	X	X	X	X
RS-232 with D9 Connection	D, **E**	**OPTD3**		**D3**		X	X	X	X	X	X	X
Keypad												
9000X Series Local/ Remote Keypad (Replacement Keypad)	—	**KEYPAD-LOC/ REM**		**—**		—	—	—	—	—	—	X
9000X Series Remote Mount Keypad Unit (Keypad not included, includes 10 ft. cable, keypad holder, mounting hardware)	—	**OPTRMT-KIT-9000X**		**—**		—	—	—	—	—	—	—
9000X Series RS-232 Cable, 13 ft.	—	**PP00104**		**—**		—	—	—	—	—	—	—

① Option card must be installed in one of the slots listed for that card. Slot indicated in Bold is the preferred location.
② AI = Analog Input; AO = Analog Output, DI = Digital Input, DO = Digital Output, RO = Relay Output
③ OPTC2 is a multi-protocol option card.

Discount Symbol........................ **SS-2**

Johnson Controls Metasys™ N2 Network Communications

The OPTC2 fieldbus board provides communication between the 9000X Drive and a Johnson Controls Metasys™ N2 network. With this connection, the drive can be controlled, monitored and programmed from the Metasys system. The N2 fieldbus is available as a factory installed option and as a field installable kit.

Modbus/TCP Network Communications

The Modbus/TCP Network Card OPTCI is used for connecting the 9000X Drive to Ethernet networks utilizing Modbus protocol. It includes an RJ-45 pluggable connector. This interface provides a selection of standard and custom register values to communicate drive parameters. The board supports 10 Mbps and 100 Mbps communication speeds. The IP address of the board is configurable over Ethernet using a supplied software tool.

BACnet Network Communications

The BACnet Network Card OPTCJ is used for connecting the 9000X Drive to BACnet networks. It includes a 5.08 mm pluggable connector. Data transfer is Master-Slave/Token Passing (MS/TP) RS-485. This interface uses a collection of 30 Binary Value Objects (BVOs) and 35 Analog Value Objects (AVOs) to communicate drive parameters. The card supports 9.6, 19.2 and 38.4 Kbaud communication speeds and supports network addresses 1 – 127.

Ethernet/IP Network Communications

The Ethernet/IP Network Card OPTCK is used for connecting the 9000X Drive to Ethernet/Industrial Protocol networks. It includes an RJ-45 pluggable connector. The interface uses CIP objects to communicate drive parameters (CIP is "Common Industrial Protocol", the same protocol used by DeviceNet). The board supports 10 Mbps and 100 Mbps communication speeds. The IP address of the board is configurable by Static, BOOTP and DHCP methods.

Modbus RTU Network Communications

The Modbus Network Card OPTC2 is used for connecting the 9000X Drive as a slave on a Modbus network. The interface is connected by a 9-pin DSUB connector (female) and the baud rate ranges from 300 to 19200 baud. Other communication parameters include an address range from 1 to 247; a parity of None, Odd or Even; and the stop bit is 1.

Profibus Network Communications

The Profibus Network Card OPTC3 is used for connecting the 9000X Drive as a slave on a Profibus-DP network. The interface is connected by a 9-pin DSUB connector (female). The baud rates range from 9.6K baud to 12M baud, and the addresses range from 1 to 127.

LonWorks Network Communications

The LonWorks Network Card OPTC4 is used for connecting the 9000X Drive on a LonWorks network. This interface uses Standard Network Variable Types (SNVT) as data types. The channel connection is achieved using a FTT-10A Free Topology transceiver via a single twisted transfer cable. The communication speed with LonWorks is 78 kBits/s.

CanOpen (Slave) Communications

The CanOpen (Slave) Network Card OPTC6 is used for connecting the 9000X Drive to a host system. According to ISO11898 standard cables to be chosen for CAN bus should have a nominal impedance of 120Ω, and specific line delay of nominal 5 nS/m. 120Ω line termination resistors required for installation.

DeviceNet Network Communications

The DeviceNet Network Card OPTC7 is used for connecting the 9000X Drive on a DeviceNet Network. It includes a 5.08 mm pluggable connector. Transfer method is via CAN using a 2-wire twisted shielded cable with 2-wire bus power cable and drain. The baud rates used for communication include 125K baud, 250K baud and 500K baud.

Options

Control Panel Options

Table 40-214. Control Panel Factory Options

Description	Factory Installed		Field Installed	
			NEMA Type 1	
	Option Code	Adder U.S. $	Catalog Number	Price U.S. $
Local/Remote Keypad SVX9000 Control Panel — This option is standard on all drives and consists of an RS-232 connection, backlit alphanumeric LCD display with nine indicators for the RUN status and two indicators for the control source. The nine pushbuttons on the panel are used for panel programming and monitoring of all SPX9000 parameters. The panel is detachable and isolated from the input line potential. Include LOC/REM key to choose control location.	A		KEYPAD-LOC/REM	
Keypad Remote Mounting Kit — This option is used to remote mount the SPX9000 keypad. The footprint is compatible to the SV9000 remote mount kit. Includes 10 ft. cable, keypad holder and mounting hardware.	—		OPTRMT-KIT-9000X	
Keypad Blank — 9000X Series select keypad for use with special and custom applications.	—		KEYPAD-BLANK	

Discount Symbol SS-2

Table 40-215. Miscellaneous Options

Description	Catalog Number	Price U.S. $
9000XDrive — A PC-based tool for controlling and monitoring of the SPX9000. Features include: loading parameters that can be saved to a file or printed, setting references, starting and stopping the motor, monitoring signals in graphical or text form, and real-time display. To avoid damage to the drive or computer, SVDrivecable must be used.	**9000XDRIVE**	
SVDrivecable — 6 ft. (1.8m) RS-232 cable (22 gauge) with a 7-pin connector on each end. Should be used in conjunction with the 9000X Drive option to avoid damage to the SPX9000 or computer. The same cable can be used for downloading specialized applications to the drive.	**SVDRIVECABLE**	
External Dynamic Braking Resistors — Used with the Dynamic Braking Chopper Circuit to absorb motor regenerative energy for stopping the load and to dissipate the energy flowing back into the drive. Resistors are separated into Standard Duty and Heavy-Duty. Standard Duty is defined as 20% duty or less with 100% braking torque, while Heavy-Duty is defined as 50% duty or less with 150% braking torque. *Consult factory.*	①	

① Consult factory.

Brake Chopper Options

The Brake Chopper Circuit option is used for applications that require dynamic braking. Dynamic Braking resistors not included with drive purchase. Consult the factory for dynamic braking resistors which are supplied separately. Resistors not UL Listed.

Table 40-216. Brake Chopper Circuit Adder — NEMA Type 1, NEMA Type 12, Chassis

hp (I_H)	Adder U.S. $		
	208 – 240V	380 – 500V	525 – 690V
2 3 5vt 5ct 7-1/2vt 7-1/2ct			
10 15 20 25 30 40			
50 60 75 100 125 150			
200vt 200ct 250 300 350 400			
450 500 550 600vt 600ct 700vt 700ct			
800 900 1000 1200 1350 1500 1600 1900 2000			

Note: Delivery code is FP.

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Discount Symbol........................ **SS-2**

Table 40-217. Conformal (Varnished) Coating Adder — 208 – 240V, 380 – 500V, 525 – 690V
(See Catalog Number Description to order.)

Frame	Delivery Code	Adder U.S. $
FR4 FR5 FR6	FP FP FP	
FR7 FR8 FR9	FP FP FP	
FR10 FR11 FR12 FR13 FR14	FP FP FP FP FP	

Table 40-218. Conformal Coated Board Kits ①

Field Installed		Factory Installed	
Catalog Number	Price U.S. $	Option Designator	Adder U.S. $
OPT_V ③		②	

① See Option Catalog Numbers on **Page 40-139**.
② Construct Catalog Numbers for factory installed per **Table 40-200** on **Page 40-134**.
③ Replace "__" with the correct Catalog Number from **Page 40-139**. Example: OPT**C2**V.

Accessories

Demo Drive and Power Supply

Table 40-219. Demo Drive and Power Supply

Description	Catalog Number	Price U.S. $
9000X Drive Demo	**9000XDEMO**	
Hand Held 24V Auxiliary Power Supply — used to supply power to the control module in order to perform keypad programming before the drive is connected to line voltage	**9000XAUX24V**	

NEMA Type 12 Conversion Kit

The NEMA Type 12 kit option is used to convert a NEMA Type 1 to a NEMA Type 12 drive. The NEMA Type 12 Kit consists of a metal drive shroud, fan kit for some frames, adaptor plate and plugs.

Table 40-220. NEMA Type 12 Conversion Kit

Frame Size	Delivery Code	Approximate Dimensions in Inches (mm)			Approximate Weight in Lb. (kg)	Catalog Number	Price U.S. $
		Length	Width	Height	Weight		
FR4 FR5 FR6	W W W	13 (330) 16 (406) 21 (533)	7 (178) 8 (203) 10 (254)	4 (102) 7 (178) 5 (127)	4 (1.8) 5 (2.3) 7 (3.2)	**OPTN12FR4** **OPTN12FR5** **OPTN12FR6**	

Flange Kits

Flange Kit Type 12

The flange kit is utilized when the power section is mounted through the back panel of an enclosure. Includes flange mount brackets and NEMA Type 12 fan components. Metal shroud not included.

Table 40-221. Flange Kit Type 12 — Frames 4, 5 and 6 ④

Frame Size	Delivery Code	Catalog Number	Price U.S. $
FR4 FR5 FR6	W W W	**OPTTHRFR4** **OPTTHRFR5** **OPTTHRFR6**	

④ For installation of an SPX9000 NEMA Type 1 drive into a NEMA Type 12 oversized enclosure.

Flange Kit Type 1

Flange kits for NEMA 1 enclosure drive rating determined by rating of drive.

Table 40-222. Flange Kit Type 1 — Frames 4 – 9 ⑤

Frame Size	Delivery Code	Catalog Number	Price U.S. $
FR4 FR5 FR6	FP FP FP	**OPTTHR4** **OPTTHR5** **OPTTHR6**	
FR7 FR8 FR9	FP FP FP	**OPTTHR7** **OPTTHR8** **OPTTHR9**	

⑤ For installation of an SPX9000 NEMA Type 1 drive into a NEMA Type 1 oversized enclosure.

Flange Kit Type 12

Flange kits for NEMA 12 enclosure drive rating determined by rating of drive.

Table 40-223. Flange Kit Type 12 — Frames 4 – 9 ⑥

Frame Size	Delivery Code	Catalog Number	Price U.S. $
FR4 FR5 FR6	FP FP FP	**OPTTHR4** **OPTTHR5** **OPTTHR6**	
FR7 FR8 FR9	FP FP FP	**OPTTHR7** **OPTTHR8** **OPTTHR9**	

⑥ For installation of an SPX9000 NEMA Type 12 drive into a NEMA Type 12 oversized enclosure.

Discount Symbol **SS-2**

Control/Communication Option Descriptions

Table 40-224. Available Control/Communications Options

Option	Description	Option Type
K2	**Door-Mounted Speed Potentiometer with HOA Selector Switch** — Provides the SPX9000 with the ability to start/stop and adjust the speed reference from door-mounted control devices or remotely from customer supplied inputs. In HAND position, the drive will start and the speed is controlled by the door-mounted speed potentiometer. The drive will be disabled in the OFF position. When AUTO is selected, the drive run and speed control commands are via user-supplied dry contact and 4 – 20 mA signal.	Control
K4	**HAND/OFF/AUTO Switch for Non-bypass Configurations** — Provides a three-position selector switch that allows the user to select either a Hand or Auto mode of operation. Hand mode is defaulted to keypad operation, and Auto mode is defaulted to control from an external terminal source. These modes of operation can be configured via programming to allow for alternate combinations of start and speed sources. Start and speed sources include Keypad, I/O and FieldBus.	Control
KB	**115V Control Transformer – 550 VA** — Provides a fused control power transformer with additional 550 VA at 115V for customer use.	Control
L1	**Power On and Fault Pilot Lights** — Provides a white power on light that indicates power to the enclosed cabinet and a red fault light indicates a drive fault has occurred.	Light
P2	**Disconnect Switch** — Disconnect switch option is applicable only with NEMA Type 1 and NEMA Type 12 Freestanding drives. Allows a convenient means of disconnecting the SPX9000 from the line, and the operating mechanism can be padlocked in the OFF position. This is factory-mounted in the enclosure.	Input

SPX Freestanding Options

Table 40-225. 480V and 690V Control Options

Catalog Number Suffix ➡	Door-Mounted Speed Potentiometer with HOA Selector Switch	HAND/OFF/AUTO Switch (22 mm)	115 Volt Control Transformer 550 VA
	K2	K4	KB
hp	Adder U.S. $	Adder U.S. $	Adder U.S. $
200 – 550			

Table 40-226. 480V and 690V Light Options

Catalog Number Suffix ➡	Power On/ Fault Pilot Lights
	L1
hp	Adder U.S. $
200 – 550	

Table 40-227. Input Options

Catalog Number Suffix ➡	Disconnect Switch
	P2 ①
hp	Adder U.S. $
200 250 300 350	
400 500 550	

① Applicable with FR10 and FR11 Freestanding designs only.

Discount Symbol SS-3

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Dimensions

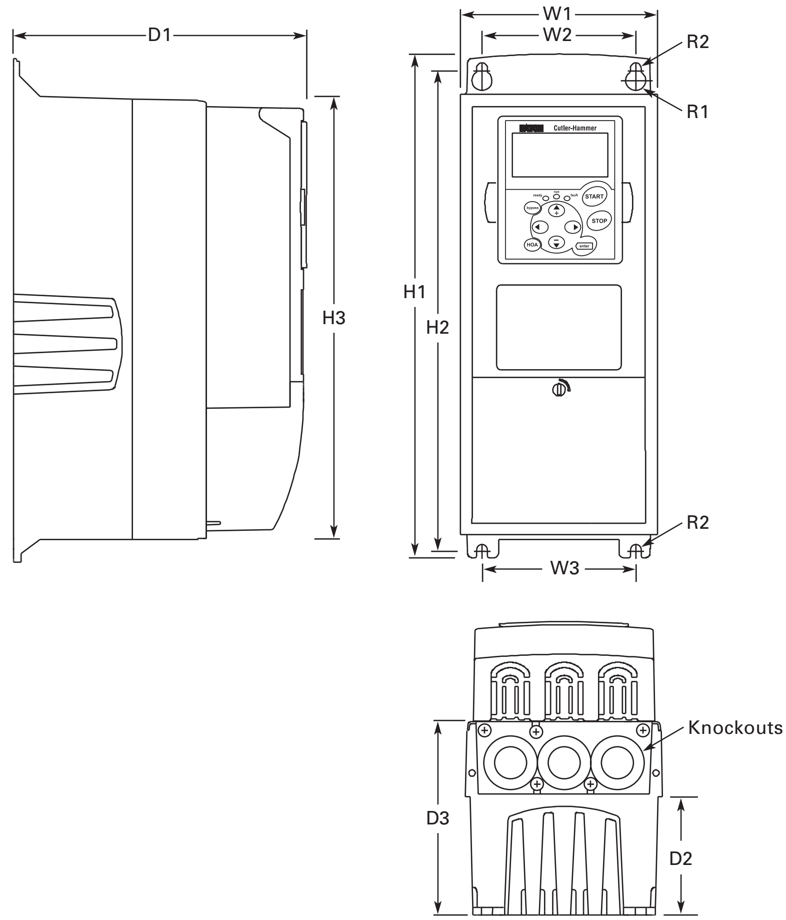


Figure 40-66. NEMA Type 1 and NEMA Type 12 SPX9000 Drive Dimensions, FR4, FR5 and FR6

Table 40-228. SPX9000 Drive Dimensions

Frame Size	Voltage	hp (I_H)	Approximate Dimensions in Inches (mm)											Weight Lbs. (kg)	Knockouts @ Inches (mm)
			H1	H2	H3	D1	D2	D3	W1	W2	W3	R1 dia.	R2 dia.		N1 (O.D.)
FR4	230V	3/4 – 3	12.9 (327)	12.3 (313)	11.5 (292)	7.5 (190)	3.0 (77)	5.0 (126)	5.0 (128)	3.9 (100)	—	.5 (13)	.3 (7)	11.0 (5)	3 @ 1.1 (28)
	480V	1 – 5													
FR5	230V	5 – 7-1/2	16.5 (419)	16.0 (406)	15.3 (389)	8.4 (214)	3.9 (100)	5.8 (148)	5.7 (144)	3.9 (100)	—	.5 (13)	.3 (7)	17.9 (8)	2 @ 1.5 (37) 1 @ 1.1 (28)
	480V	7-1/2 – 15													
FR6	230V	10 – 15	22.0 (558)	21.3 (541)	20.4 (519)	9.3 (237)	4.2 (105)	6.5 (165)	7.6 (195)	5.8 (148)	—	.6 (15.5)	.4 (9)	40.8 (19)	3 @ 1.5 (37)
	480V	20 – 30													
	575V	2 – 25													

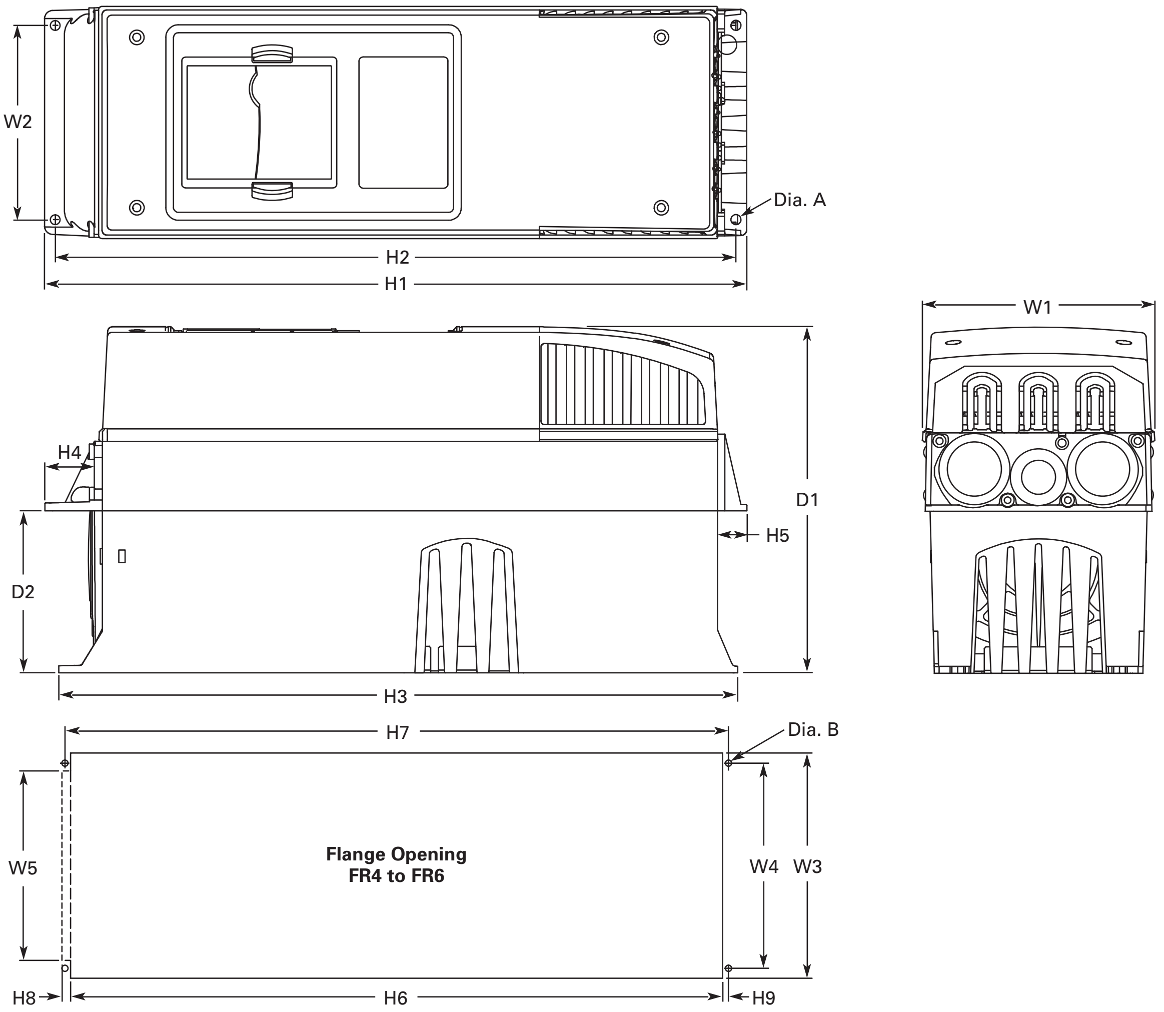


Figure 40-67. SPX9000 Dimensions, NEMA Type 1 and NEMA Type 12 with Flange Kit, FR4, FR5 and FR6

Table 40-229. Dimensions for SPX9000, FR4, FR5 and FR6 with Flange Kit

Frame Size	Approximate Dimensions in Inches (mm)									
	W1	W2	H1	H2	H3	H4	H5	D1	D2	Dia. A
FR4	5.0 (128)	4.5 (113)	13.3 (337)	12.8 (325)	12.9 (327)	1.2 (30)	.9 (22)	7.5 (190)	3.0 (77)	.3 (7)
FR5	5.6 (143)	4.7 (120)	17.0 (434)	16.5 (420)	16.5 (419)	1.4 (36)	.7 (18)	8.4 (214)	3.9 (100)	.3 (7)
FR6	7.7 (195)	6.7 (170)	22.0 (560)	21.6 (549)	22.0 (558)	1.2 (30)	.8 (20)	9.3 (237)	4.2 (106)	.3 (7)

Table 40-230. Dimensions for the Flange Opening, FR4 to FR6

Frame Size	Approximate Dimensions in Inches (mm)							
	W3	W4	W5	H6	H7	H8	H9	Dia. B
FR4	4.8 (123)	4.5 (113)	—	12.4 (315)	12.8 (325)	—	.2 (5)	.3 (7)
FR5	5.3 (135)	4.7 (120)	—	16.2 (410)	16.5 (420)	—	.2 (5)	.3 (7)
FR6	7.3 (185)	6.7 (170)	6.2 (157)	21.2 (539)	21.6 (549)	.3 (7)	.2 (5)	.3 (7)

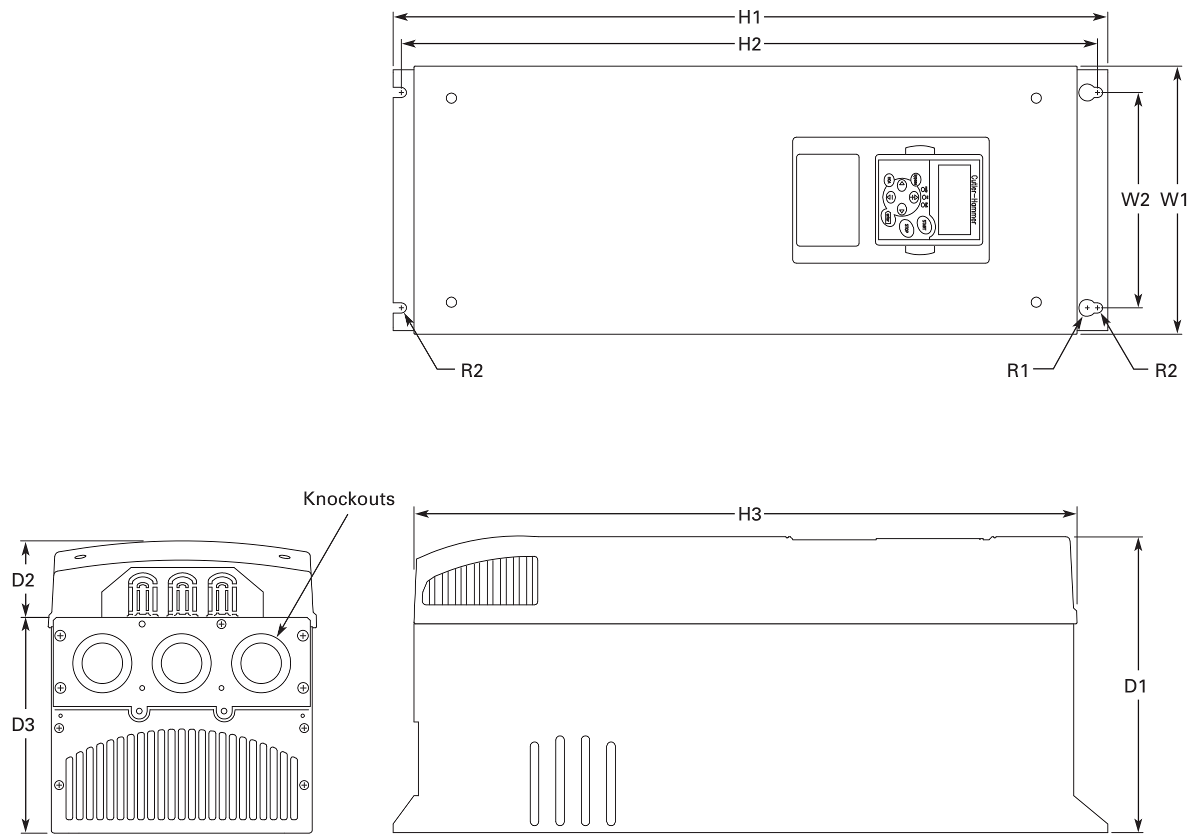


Figure 40-68. SPX9000 Dimensions, NEMA Type 1 and NEMA Type 12, FR7

Table 40-231. SPX9000 Drive Dimensions, FR7

Frame Size	Voltage	hp (I_H)	Approximate Dimensions in Inches (mm)										Weight Lbs. (kg)	Knockouts @ Inches (mm)
			H1	H2	H3	D1	D2	D3	W1	W2	R1 dia.	R2 dia.		N1 (O.D.)
FR7	230V	20 – 30	24.8 (630)	24.2 (614)	23.2 (590)	10.1 (257)	3.0 (77)	7.3 (184)	9.3 (237)	7.5 (190)	.7 (18)	.4 (9)	77.2 (35)	3 @ 1.5 (37)
	480V	40 – 60												
	575V	30 – 40												

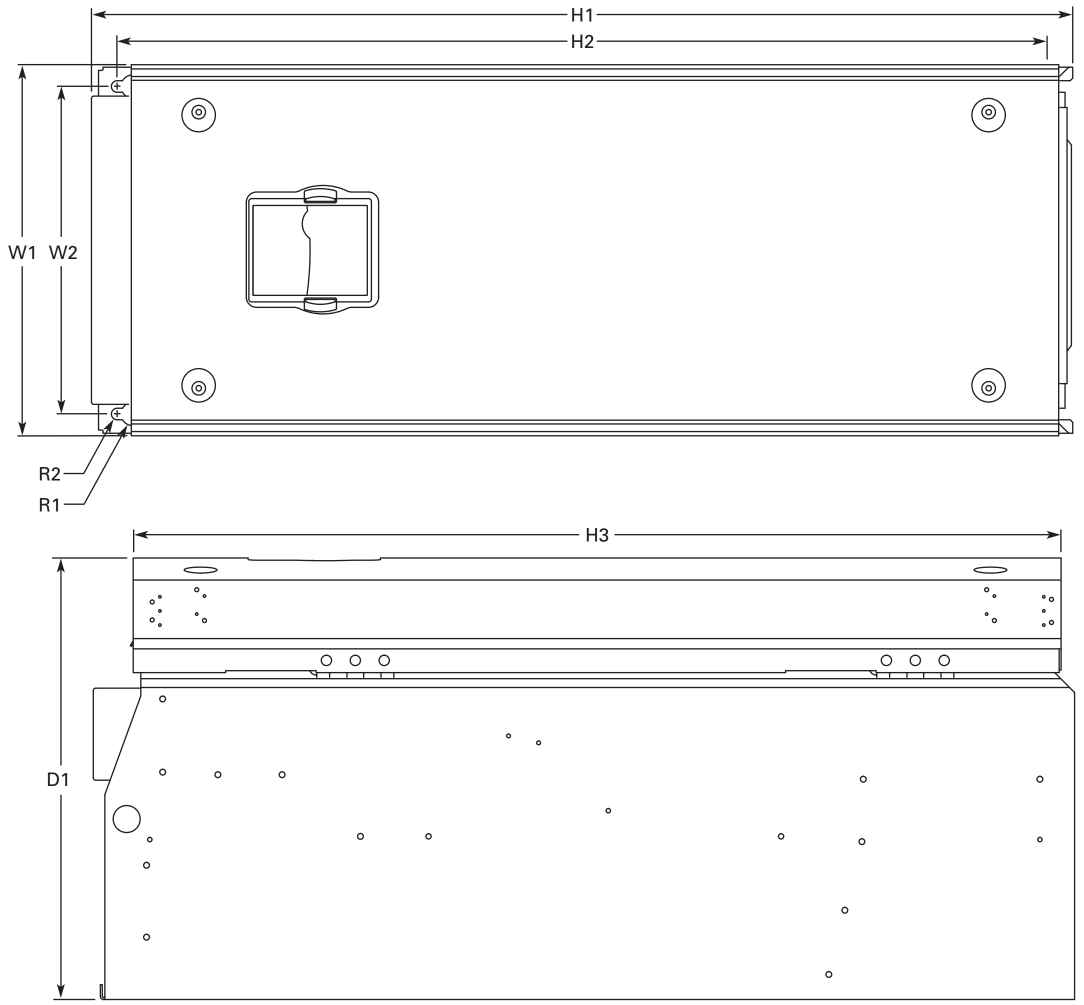


Figure 40-69. SPX9000 Dimensions, NEMA Type 1 and NEMA Type 12, FR8

Table 40-232. SPX9000 Drive Dimensions, FR8

Frame Size	Voltage	hp (I_H)	Approximate Dimensions in Inches (mm)								Weight Lbs. (kg)
			D1	H1	H2	H3	W1	W2	R1 dia.	R2 dia.	
FR8	230V	40 – 60	13.5 (344)	30.1 (764)	28.8 (732)	28.4 (721)	11.5 (291)	10 (255)	.7 (18)	.4 (9)	127 (58)
	480V	75 – 125									
	575V	50 – 75									

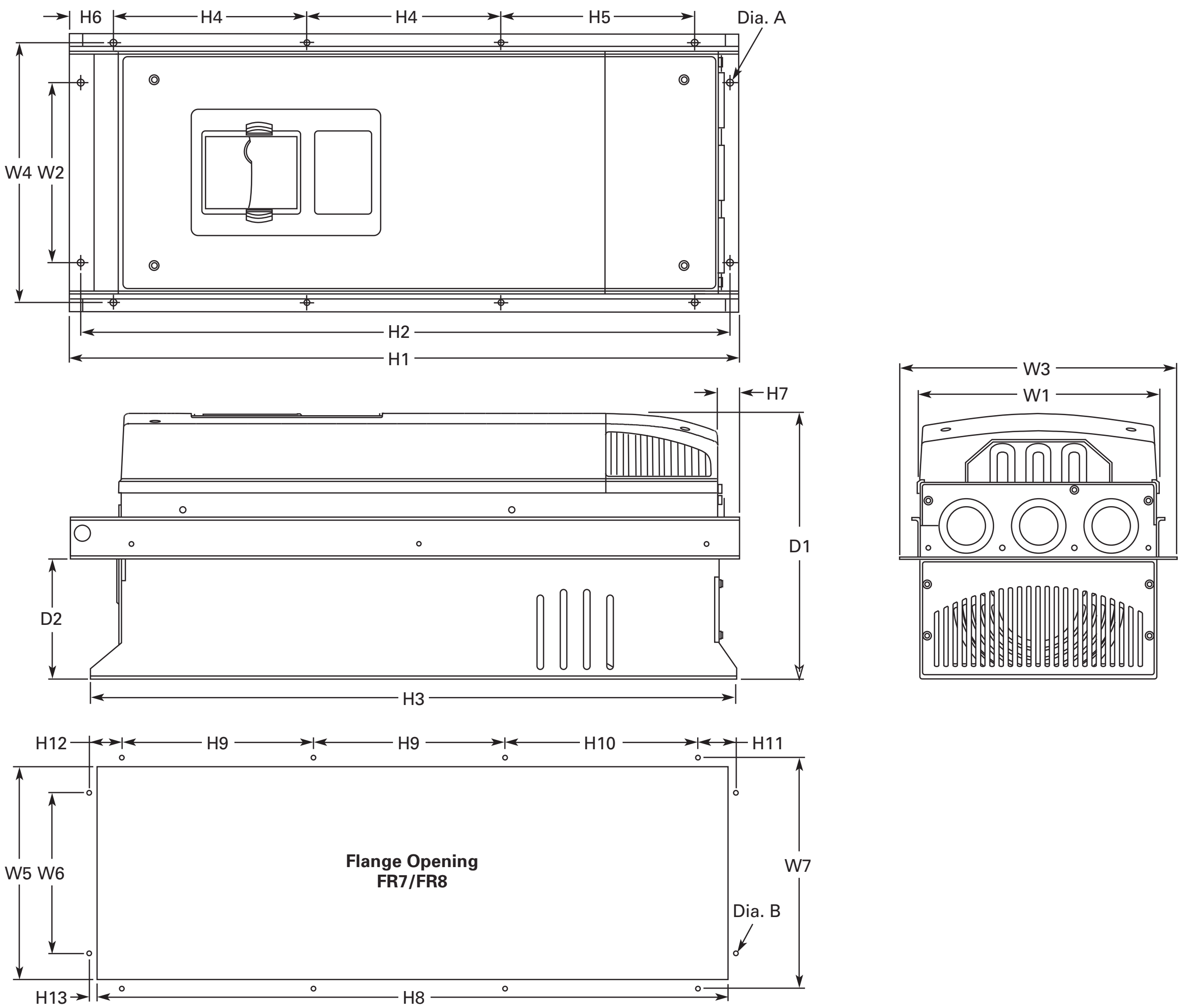


Figure 40-70. SPX9000 Dimensions, NEMA Type 1 and NEMA Type 12, with Flange Kit, FR7 and FR8

Table 40-233. Dimensions for SPX9000, FR7 and FR8 with Flange Kit

Frame Size	Approximate Dimensions in Inches (mm)													
	W1	W2	W3	W4	H1	H2	H3	H4	H5	H6	H7	D1	D2	Dia. A
FR7	9.3 (237)	6.8 (175)	10.6 (270)	10.0 (253)	25.6 (652)	24.8 (632)	24.8 (630)	7.4 (189)	7.4 (189)	.9 (23)	.8 (20)	10.1 (257)	4.6 (117)	.3 (6)
FR8	11.2 (285)	—	14.0 (355)	13.0 (330)	32.8 (832)	—	29.3 (745)	10.2 (258)	10.4 (265)	1.7 (43)	2.2 (57)	13.5 (344)	4.3 (110)	.4 (9)

Table 40-234. Dimensions for the Flange Opening, FR7/FR8

Frame Size	Approximate Dimensions in Inches (mm)									
	W5	W6	W7	H8	H9	H10	H11	H12	H13	Dia. B
FR7	9.2 (233)	6.9 (175)	10.0 (253)	24.4 (619)	7.4 (189)	7.4 (189)	1.4 (35)	1.3 (32)	1.0 (25)	.3 (6)
FR8	11.9 (301)	—	13.0 (330)	31.9 (810)	10.2 (258)	10.4 (265)	—	—	1.3 (33)	.4 (9)

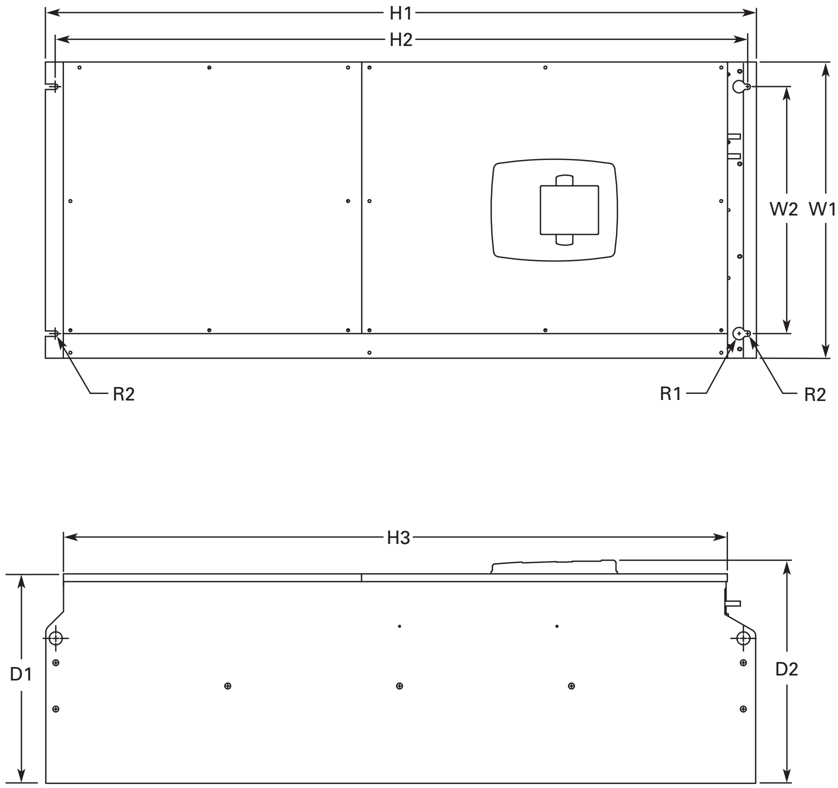


Figure 40-71. SPX9000 Dimensions, NEMA Type 1 and NEMA Type 12, FR9

Table 40-235. SPX9000 Drive Dimensions, FR9

Frame Size	Voltage	hp (I_H)	Approximate Dimensions in Inches (mm)									Weight Lbs. (kg)
			H1	H2	H3	D1	D2	W1	W2	R1 dia.	R2 dia.	
FR9	230V	75 – 100	45.3 (1150)	44.1 (1120)	42.4 (1076)	13.4 (340)	14.3 (362)	18.9 (480)	15.7 (400)	.8 (20)	.4 (9)	322 (146)
	480V	150 – 200										
	575V	100 – 175										

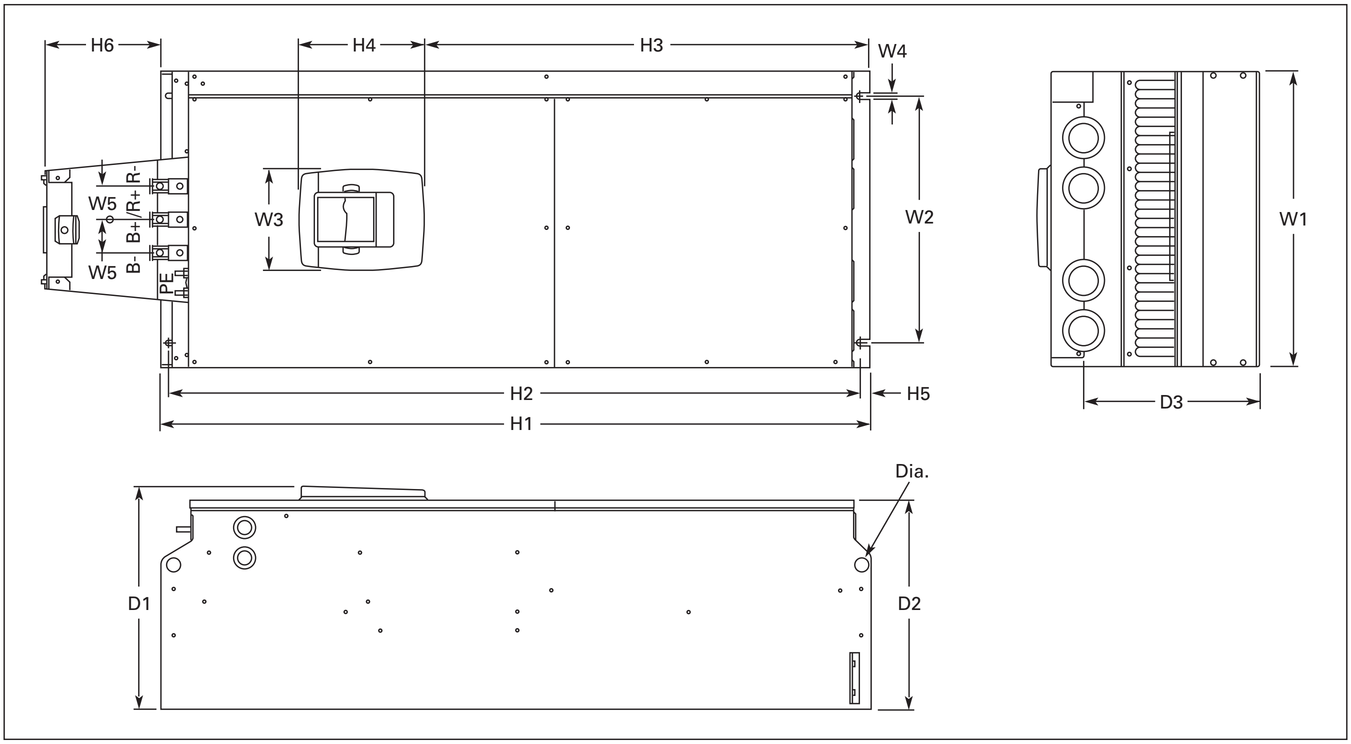


Figure 40-72. SPX9000 Dimensions, NEMA Type 1 and NEMA Type 12 FR9

Table 40-236. Dimensions for SPX9000, FR9

Frame Size	Approximate Dimensions in Inches (mm)													
	W1	W2	W3	W4	W5	H1	H2	H3	H4	H5	H6 ①	D1	D2	D3	Dia.
FR9	18.9 (480)	15.7 (400)	6.5 (165)	.4 (9)	2.1 (54)	45.3 (1150)	44.1 (1120)	28.3 (721)	8.0 (205)	.6 (16)	7.4 (188)	14.2 (361.5)	13.4 (340)	11.2 (285)	.8 (21)

① Brake resistor terminal box (H6) included when brake chopper ordered.

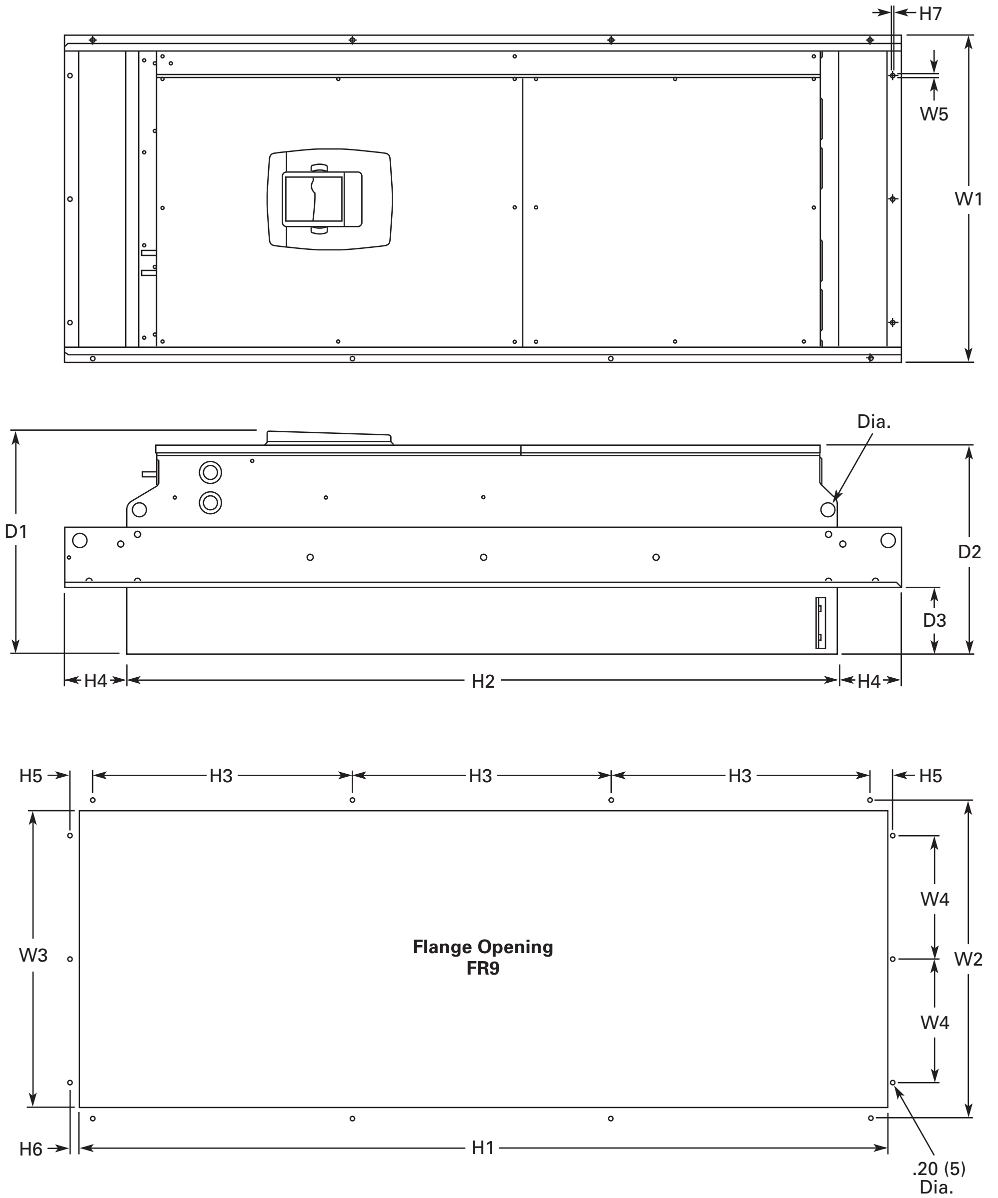


Figure 40-73. SPX9000 Dimensions, NEMA Type 1 and NEMA Type 12 FR9 with Flange Kit

Table 40-237. Dimensions for SPX9000, FR9 with Flange Kit

Frame Size	Approximate Dimensions in Inches (mm)														
	W1	W2	W3	W4	W5	H1	H2	H3	H4	H5	H6	H7	D1	D2	D3	Dia.
FR9	20.9 (530)	20.0 (510)	19.1 (485)	7.9 (200)	.2 (5.5)	51.7 (1312)	45.3 (1150)	16.5 (420)	3.9 (100)	1.4 (35)	.4 (9)	.1 (2)	24.9 (362)	13.4 (340)	4.3 (109)	.8 (21)

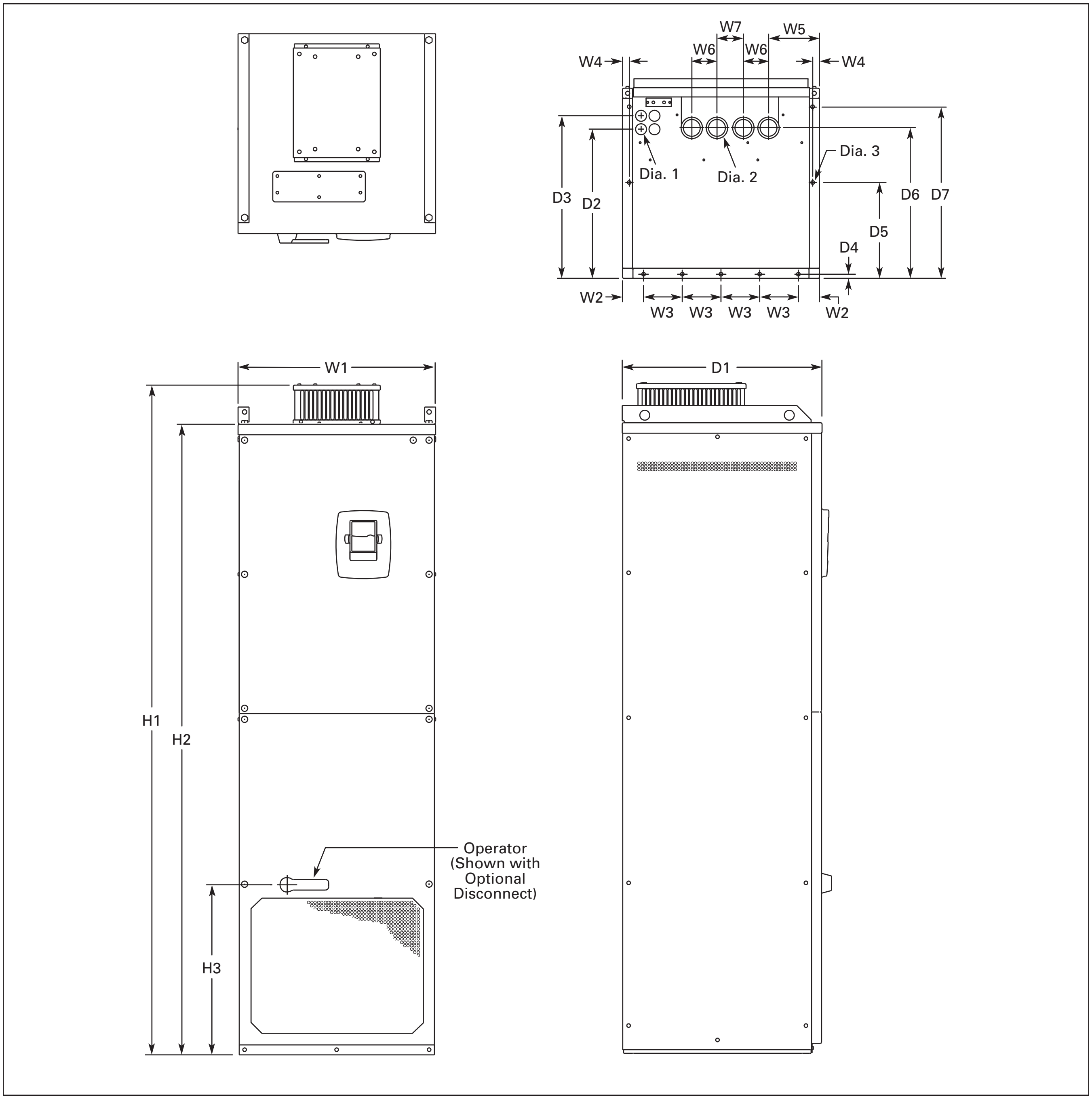


Figure 40-74. SPX9000 Dimensions, NEMA Type 1 and NEMA Type 12 FR10 Freestanding Drive

Table 40-238. Dimensions for SPX9000, FR10 Freestanding Drive

Frame Size	Volt.	hp (I_H)	Approximate Dimensions in Inches (mm)																			Wt. Lbs. (kg)
			W1	W2	W3	W4	W5	W6	W7	H1	H2	H3	D1	D2	D3	D4	D5	D6	D7	Dia. 1	Dia. 2	Dia. 3	
FR10	480V	250 – 350	23.43 (595)	2.46 (62.5)	4.53 (115)	.79 (20)	5.95 (151)	2.95 (75)	3.11 (79)	79.45 (2018)	74.80 (1900)	20.18 (512.5)	23.70 (602)	17.44 (443)	19.02 (483)	.47 (12)	11.22 (285)	17.60 (447)	20.08 (510)	.83 (21)	1.89 (48)	.43 (11)	857 (389)
	690V	200 – 300																					

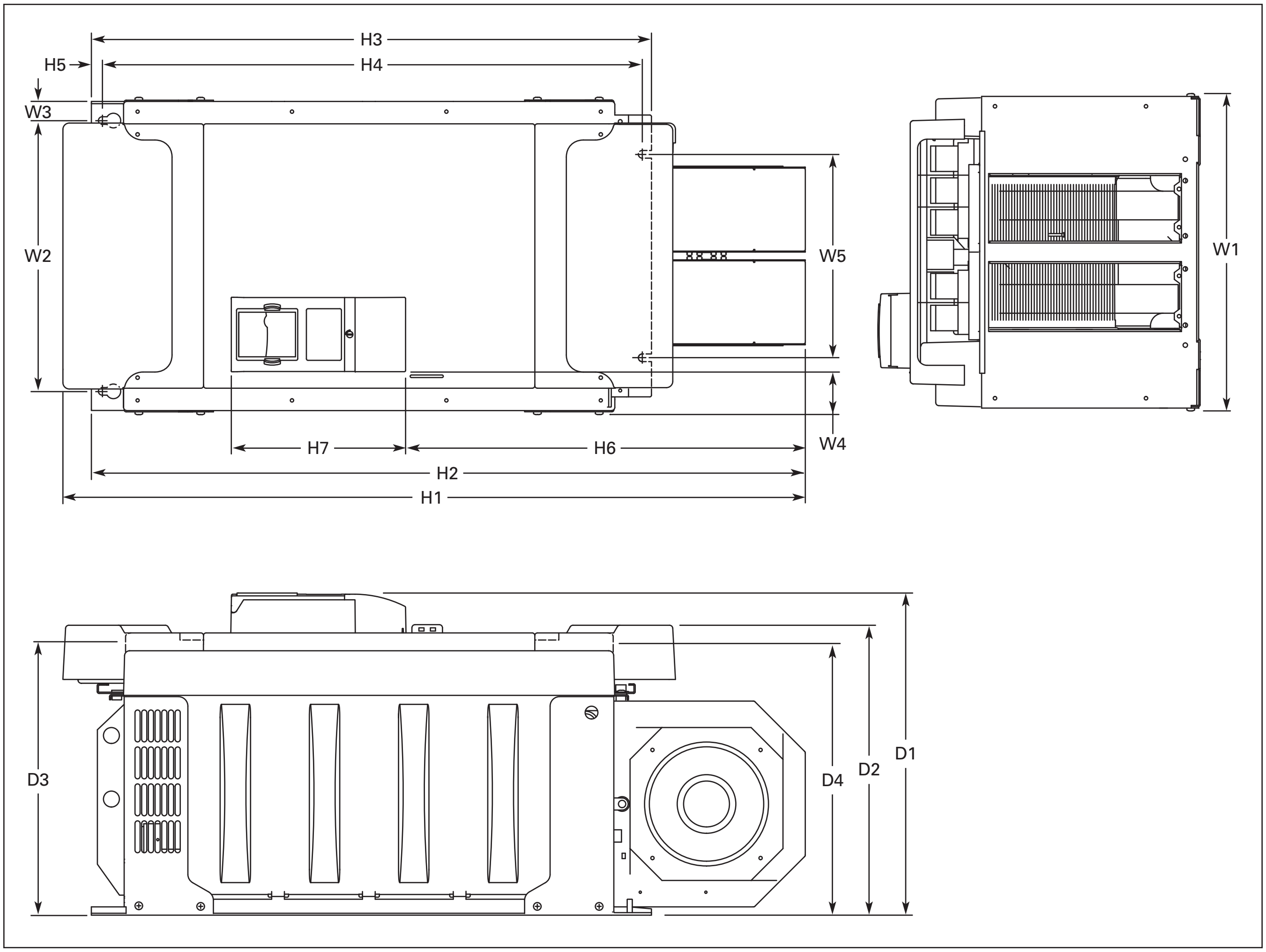


Figure 40-75. SPX9000 Dimensions, FR10 Open Chassis

Table 40-239. Dimensions for SPX9000, FR10 Open Chassis

Frame Size	Voltage	hp (I_H)	Approximate Dimensions in Inches (mm)															Weight Lbs. (kg)
			W1	W2	W3	W4	W5	H1	H2	H3	H4	H5	H6	H7	D1	D2	D3	D4	
FR10	480V	250 – 350	19.7 (500)	16.7 (425)	1.2 (30)	2.6 (67)	12.8 (325)	45.9 (1165)	44.1 (1121)	34.6 (879)	33.5 (850)	.7 (17)	24.7 (627)	10.8 (275)	19.9 (506)	17.9 (455)	16.7 (423)	16.6 (421)	518 (235)
	575V	200 – 300																	

Note: SPX9000 FR12 is built of two FR10 modules. Please refer to SPX9000 installation manual for mounting instructions.

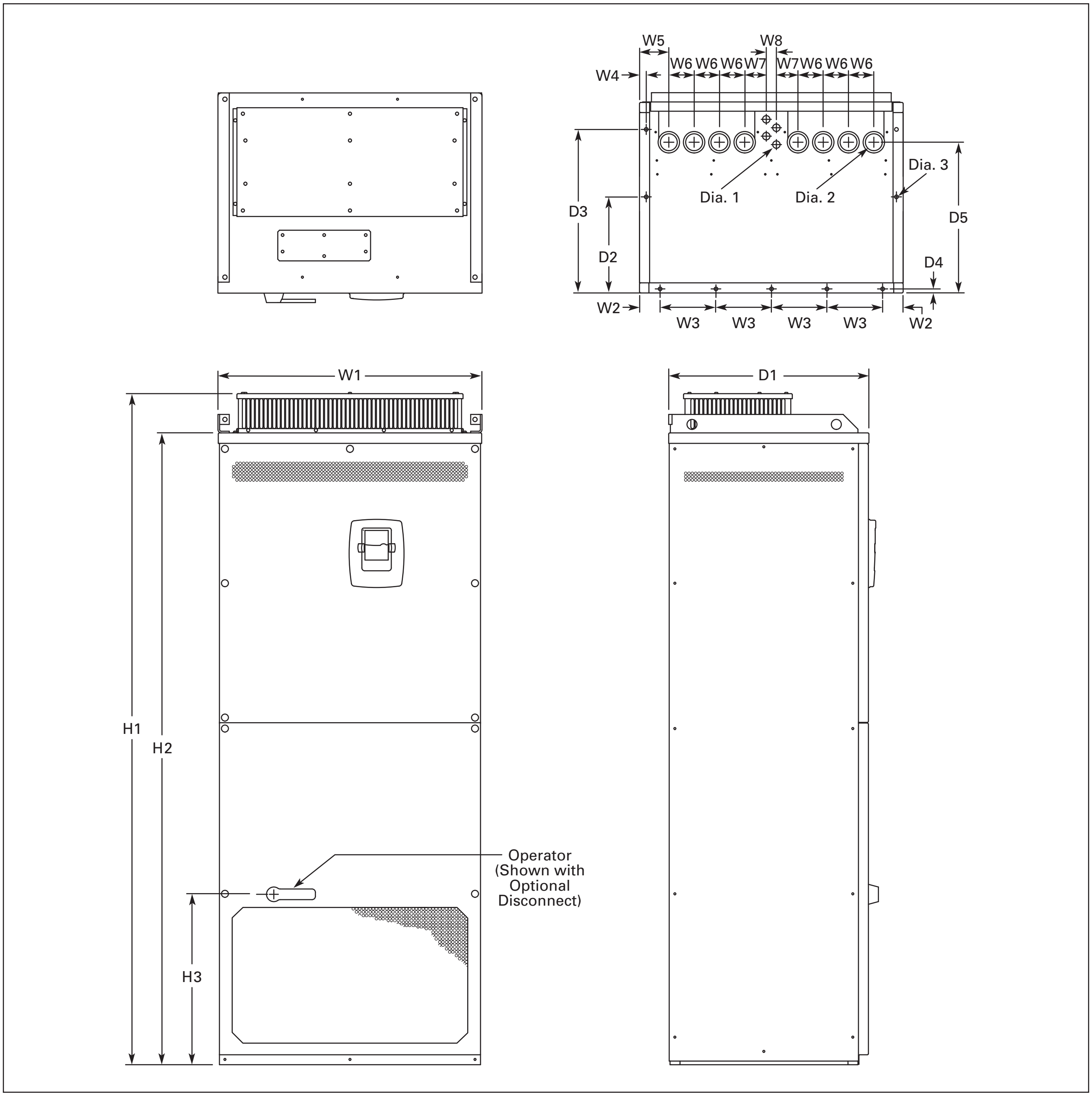


Figure 40-76. SPX9000 Dimensions, NEMA Type 1 FR11 Freestanding Drive

Table 40-240. Dimensions for SPX9000, NEMA Type 1 FR11 Freestanding Drive

Frame Size	Voltage	hp (I_H)	Approximate Dimensions in Inches (mm)																			Weight Lbs. (kg)
			W1	W2	W3	W4	W5	W6	W7	W8	H1	H2	H3	D1	D2	D3	D4	D5	Dia. 1	Dia. 2	Dia. 3	
FR11	480V	400 – 550	31.26 (794)	2.40 (61)	6.50 (165)	.79 (20)	3.43 (87)	2.95 (75)	2.52 (64)	1.18 (30)	79.45 (2018)	74.80 (1900)	20.18 (512.5)	23.70 (602)	11.22 (285)	19.09 (485)	.47 (12)	17.60 (447)	.83 (21)	1.89 (48)	.35 x .43 (9 x 11)	526 (239)
	690V	400 – 500																				

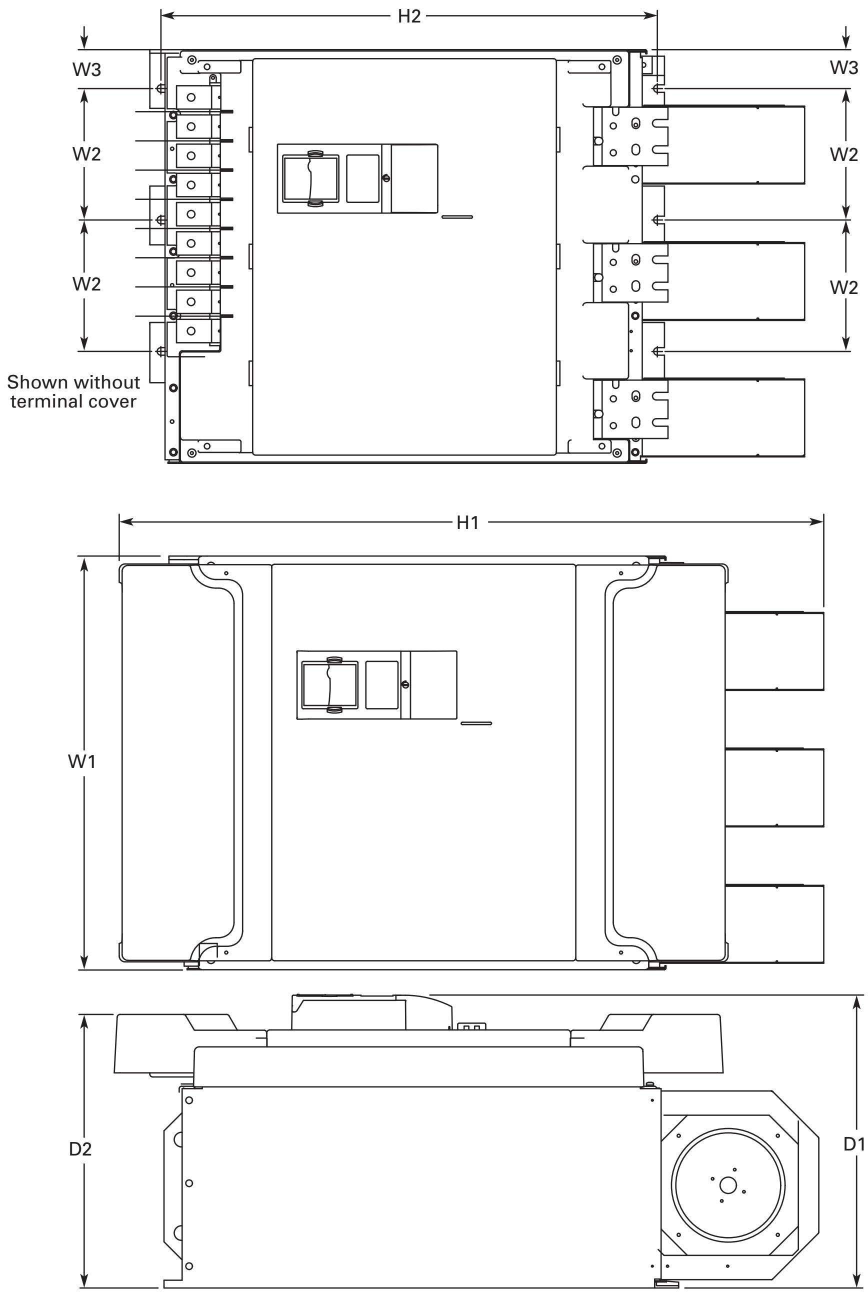


Figure 40-77. SPX9000 Dimensions, FR11 Open Chassis

Table 40-241. Dimensions for SPX9000, FR11 Open Chassis

Frame Size	Voltage	hp (I_H)	Approximate Dimensions in Inches (mm)							Weight Lbs. (kg)
			W1	W2	W3	H1	H2	D1	D2	
FR11	480V	400 – 550	27.9 (709)	8.6 (225)	2.6 (67)	45.5 (1155)	33.5 (850)	19.8 (503)	18.4 (468)	833 (378)
	575V	400 – 500								

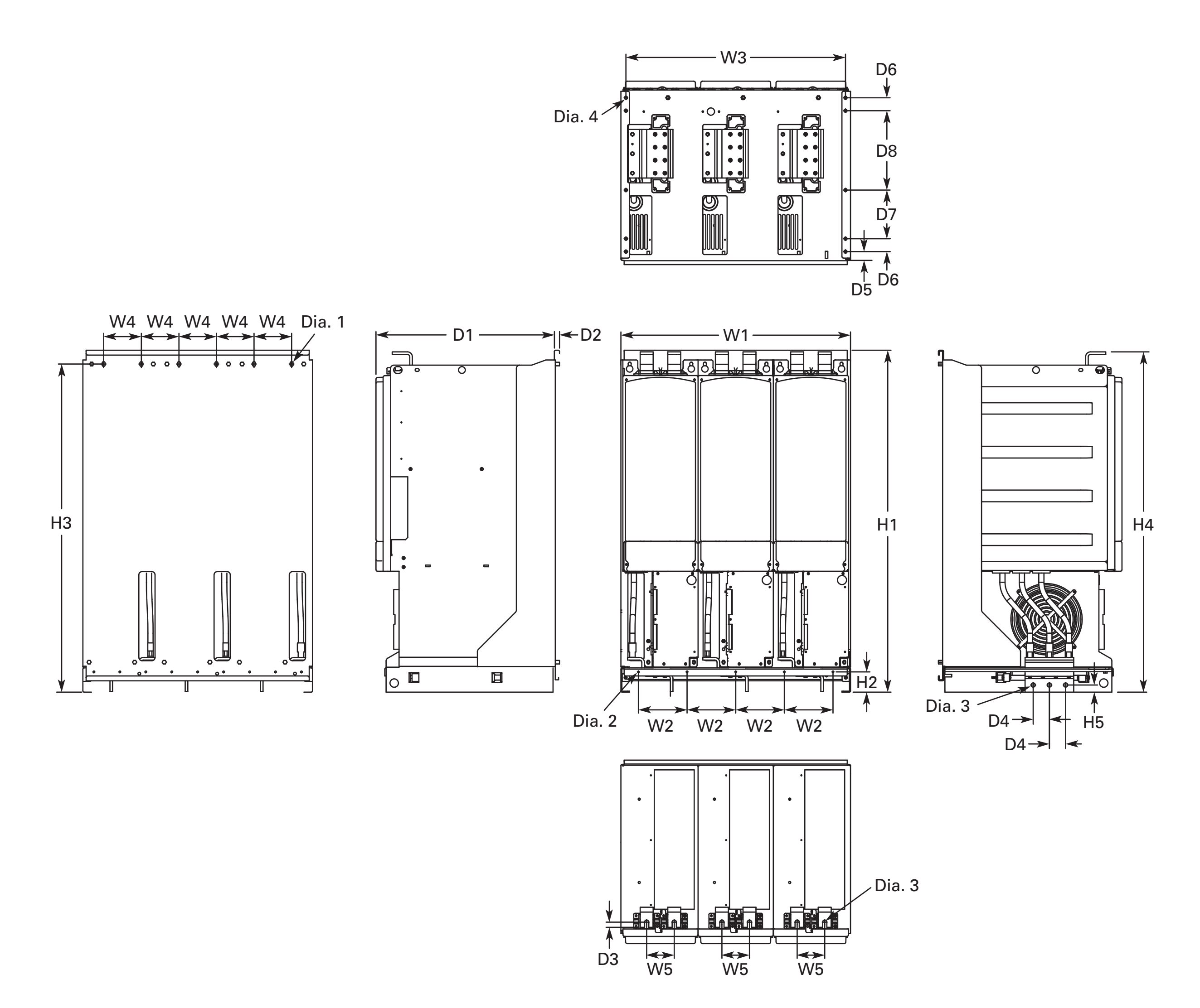


Figure 40-78. SPX9000 Dimensions, FR13 Open Chassis Inverter

Table 40-242. Dimensions for SPX9000, FR13 Open Chassis Inverter

Frame Size	Approximate Dimensions in Inches (mm)																						Weight Lbs. (kg)
	W1	W2	W3	W4	W5	H1	H2	H3	H4	H5	D1	D2	D3	D4	D5	D6	D7	D8	Dia. 1	Dia. 2	Dia. 3	Dia. 4	
FR13	27.87 (708)	5.91 (150)	26.65 (677)	4.57 (116)	3.35 (85)	41.54 (1055)	2.46 (62.5)	39.86 (1012.5)	41.34 (1050)	.79 (20)	21.77 (553)	.51 (13)	.63 (16)	1.97 (50)	1.06 (27)	1.57 (40)	5.91 (150)	9.64 (244.8)	.35x.59 (9x15)	.18 (4.6)	.51 (13)	.37 (9.5)	683 (310)

Note: 9000X FR14 is built of two FR13 modules. Please refer to SPX9000 installation manual for mounting instructions.

Note: FR13 is built from an inverter module and a converter module. Please refer to the SPX9000 installation manual for mounting instructions.

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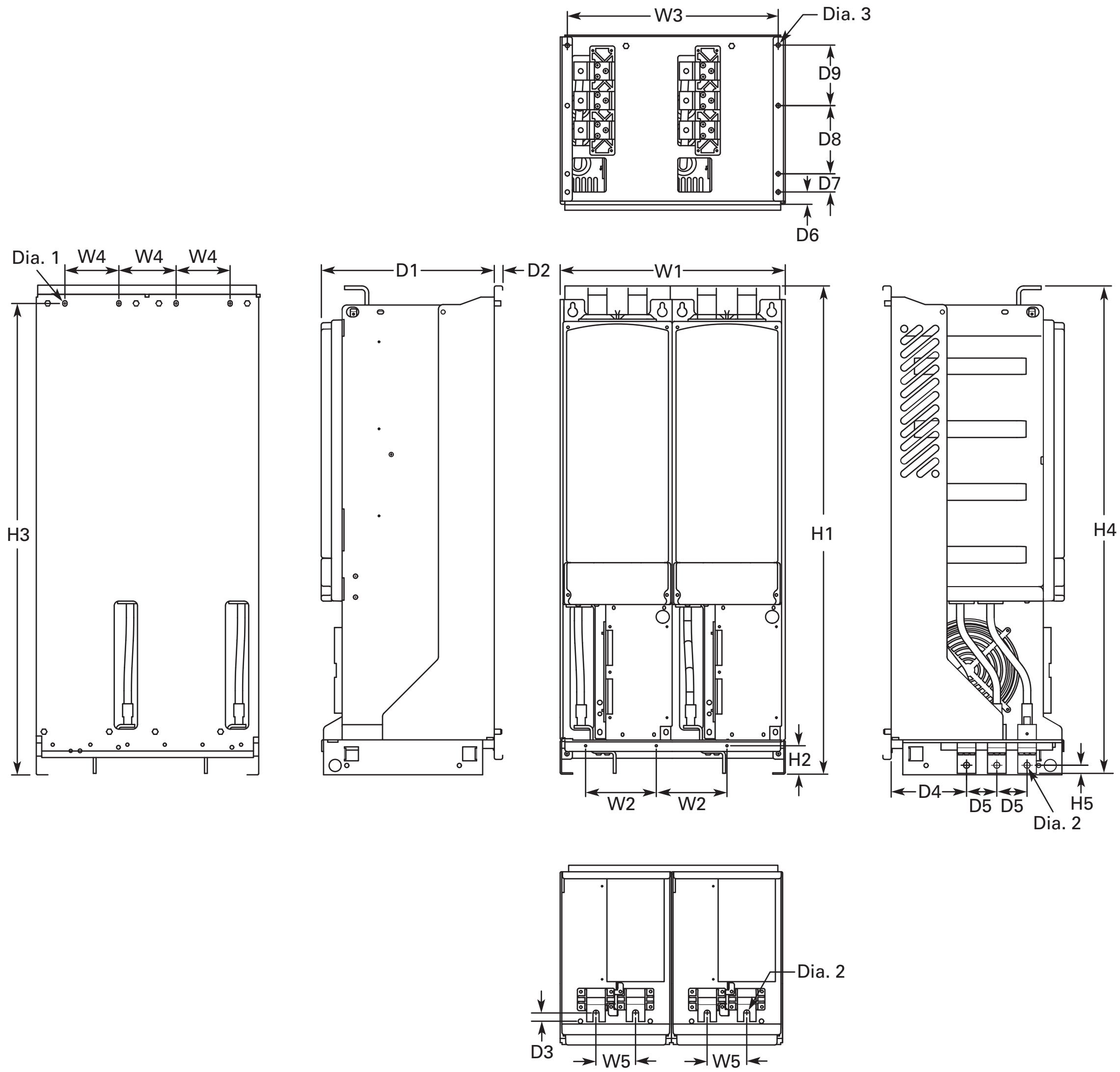


Figure 40-79. SPX9000 Dimensions, FR13 Open Chassis Converter

Table 40-243. FR13 — Number of Input Units

480V	hp	Input Modules	690V	hp	Input Modules
SPX800A0-4A2N1	800	2	**SPX800A0-5A2N1** **SPX900A0-5A2N1** **SPXH10A0-5A2N1**	800 900 1000	2 2 2

Table 40-244. Dimensions for SPX9000, FR13 Open Chassis Converter

Frame Size	Approximate Dimensions in Inches (mm)																					Weight Lbs. (kg)
	W1	W2	W3	W4	W5	H1	H2	H3	H4	H5	D1	D2	D3	D4	D5	D6	D7	D8	D9	Dia. 1	Dia. 2	Dia. 3	
FR13	18.74 (476)	5.91 (150)	17.52 (445)	4.57 (116)	3.35 (85)	41.54 (1055)	2.46 (62.5)	39.86 (1012.5)	41.34 (1050)	.69 (17.5)	14.69 (373)	.51 (13)	.73 (18.5)	6.42 (163)	2.56 (65)	1.06 (27)	1.57 (40)	5.91 (150)	5.24 (133)	.35x.59 (9x15)	.51 (13)	.37 (9.5)	295 (134)

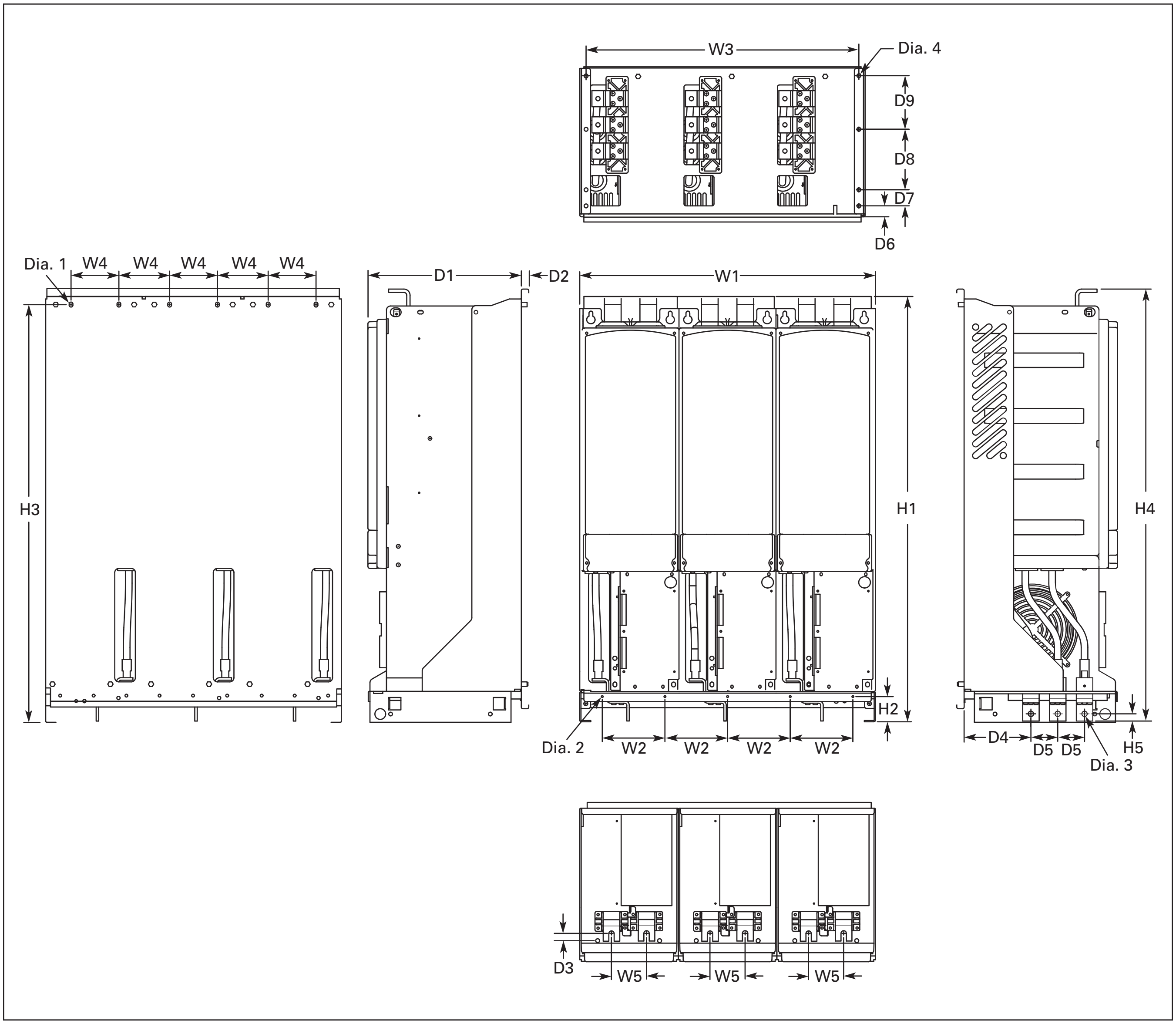


Figure 40-80. SPX9000 Dimensions, FR13 Open Chassis Converter — 900/1000 hp 480V

Table 40-245. FR13 — Number of Input Units

480V	hp	Input Modules
SPX900A0-4A2N1	900	3
SPXH10A0-4A2N1	1000	3

Table 40-246. Dimensions for SPX9000, FR13 Open Chassis Converter — 900/1000 hp 480V

Frame Size	Approximate Dimensions in Inches (mm)																							Weight Lbs. (kg)
	W1	W2	W3	W4	W5	H1	H2	H3	H4	H5	D1	D2	D3	D4	D5	D6	D7	D8	D9	Dia. 1	Dia. 2	Dia. 3	Dia. 4	
FR13	27.87 (708)	5.91 (150)	26.65 (677)	4.57 (116)	3.35 (85)	41.54 (1055)	2.46 (62.5)	39.86 (1012.5)	41.34 (1050)	.69 (17.5)	14.69 (373)	.51 (13)	.73 (18.5)	6.42 (163)	2.56 (65)	1.06 (27)	1.57 (40)	5.91 (150)	5.24 (133)	.35x.59 (9x15)	.18 (4.6)	.51 (13)	.37 (9.5)	443 (201)

Table 40-247. Choke Types

Catalog Number	Frame Size	Choke Type ①
Voltage Range 380 – 500V		
SPX 250 4	FR10	CHK0400
SPX 300 4	FR10	CHK0520
SPX 350 4	FR10	CHK0520
SPX 400 4	FR11	2 x CHK0400
SPX 500 4	FR11	2 x CHK0400
SPX 550 4	FR11	2 x CHK0400
SPX 600 4	FR12	2 x CHK0520
SPX 650 4	FR12	2 x CHK0520
SPX 700 4	FR12	2 x CHK0520
SPX 800 4	FR13	2 x CHK0400
SPX 900 4	FR13	3 x CHK0520
SPX H10 4	FR13	3 x CHK0520
SPX H12 4	FR14	4 x CHK0520
SPX H16 4	FR14	6 x CHK0400
Voltage Range 525 – 690V		
SPX 200 5	FR10	CHK0261
SPX 250 5	FR10	CHK0400
SPX 300 5	FR10	CHK0400
SPX 400 5	FR11	CHK0520
SPX 450 5	FR11	CHK0520
SPX 500 5	FR11	2 x CHK0400
SPX 550 5	FR12	2 x CHK0400
SPX 600 5	FR12	2 x CHK0400
SPX 700 5	FR12	2 x CHK0400
SPX 800 5	FR13	2 x CHK0400
SPX 900 5	FR13	2 x CHK0400
SPX H10 5	FR13	2 x CHK0400
SPX H13 5	FR14	4 x CHK0400
SPX H15 5	FR14	6 x CHK0400

① Chokes are provided with all FR10 – FR14 drives.

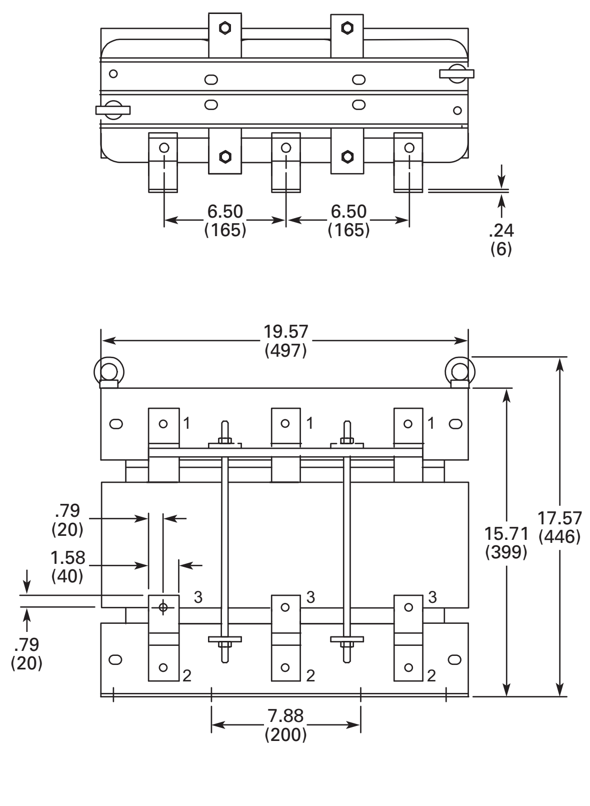


Figure 40-81. Dimensions of AC Choke CHK0520 in Inches (mm)

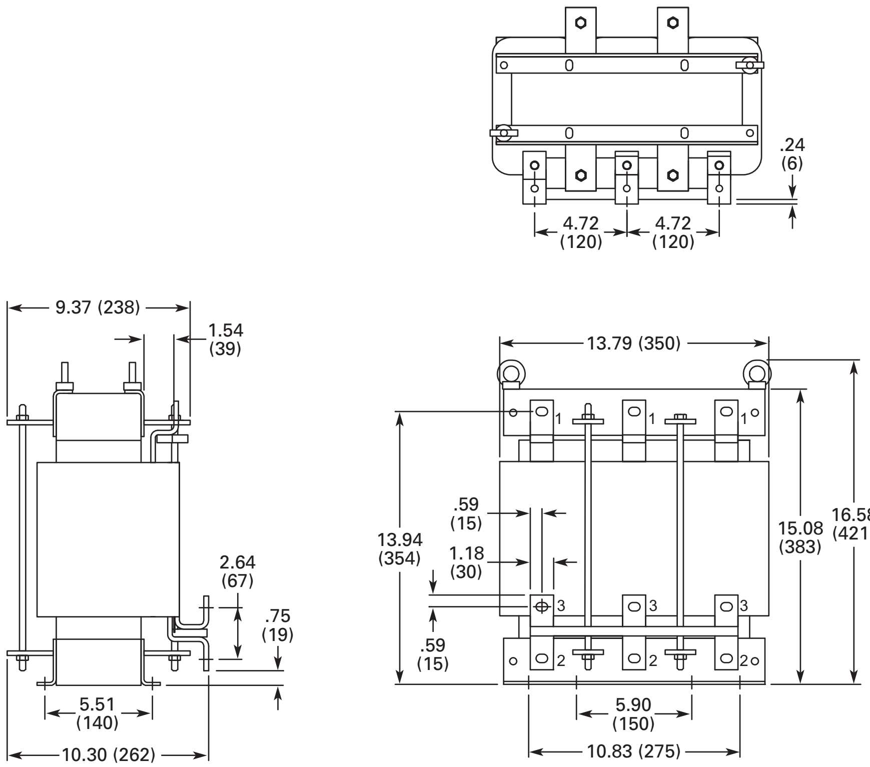


Figure 40-82. Dimensions of AC Choke CHK0400 in Inches (mm)

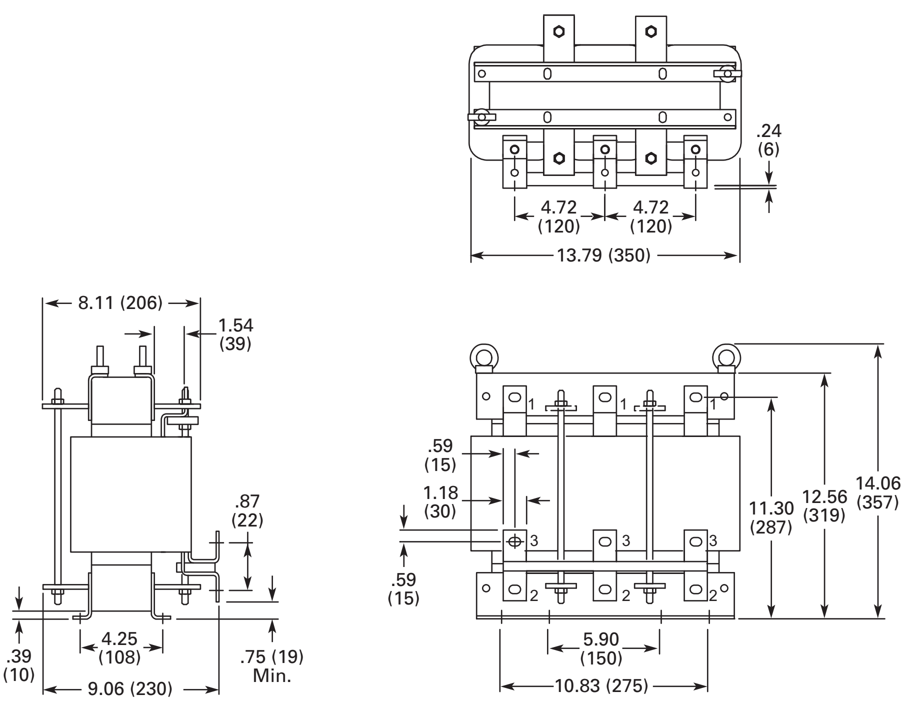


Figure 40-83. Dimensions of AC Choke CHK0261 in Inches (mm)

Spare Units & Replacement Parts

Table 40-248. 9000X Spare Units – SPX9000, 208 – 690V, Frames 4 – 12

Description	Catalog Number	Price U.S. $
Control Unit – Includes the control board, blue base housing, installed SPX9000 software program and blue flip cover. Does not include any OPT boards or keypad. See **Figure 40-65** and **Table 40-213** (**Page 40-139**) for standard and option boards and keypad.	**CPBS0000000000**	

Table 40-249. 9000X Series Replacement Parts — SPX9000 Drives, 208 – 240V

Frame:	4					5			6		7			8			Delivery Code	Catalog Number	Price U.S. $
hp (I_H):	3/4	1	1-1/2	2	3	5 ①	5	7-1/2	10	15	20	25	30	40	50	60			
Control Board																			
	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	W	**VB00561**	
Power Boards																			
	1																FB	**VB00308-0004-2**	
		1															FB	**VB00308-0007-2**	
			1														FB	**VB00308-0008-2**	
				1													FB	**VB00310-0011-2**	
					1												FB	**VB00310-0012-2**	
						1											FB	**VB00313-0017-2**	
							1										FB	**VB00313-0025-2**	
								1									FB	**VB00313-0031-2**	
									1								FB	**VB00316-0048-2**	
										1							FB	**VB00316-0061-2**	
											1						FB	**VB00319-0075-2**	
												1					FB	**VB00319-0088-2**	
													1				FB	**VB00319-0114-2**	
														1			FB	**VB00322-0140-2**	
															1		FB	**VB00322-0170-2**	
																1	FB	**VB00322-0205-2**	
Electrolytic Capacitors																			
	2	2	2														W	**PP01000**	
				2	2												W	**PP01001**	
						2	2										W	**PP01002**	
								2									W	**PP01003**	
									2	2							W	**PP01004**	
											2	2	2	4	4		W	**PP01005**	
																4	W	**PP01099**	
Cooling Fans																			
	1	1	1	1	1												W	**PP01060**	
						1	1	1									W	**PP01061**	
									1	1							W	**PP01062**	
											1	1	1				W	**PP01063**	
														1	1	1	FC	**PP01123** ②	
	1	1	1	1	1												W	**PP01086**	
						1	1	1	1	1							FC	**PP01088**	
											1	1	1				W	**PP01049**	
														1	2	2	FC	**CP01180**	
														1	1	1	FC	**PP08037**	
IGBT Modules																			
	1	1															W	**CP01304**	
			1														W	**CP01305**	
				1	1	1											W	**CP01306**	
							1										W	**CP01307**	
								1									W	**CP01308**	
									1								W	**PP01022**	
										1							W	**PP01023**	
											1						W	**PP01024**	
												1					W	**PP01025**	
													1				W	**PP01029**	
														1			W	**PP01026**	
															1	1	W	**PP01027**	

① I_L only; has no corresponding I_H rated hp rating.
② PP00061 capacitor not included in main fan; please order separately.

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Discount Symbol........................ **SS-2**

Table 40-249. 9000X Series Replacement Parts — SPX9000 Drives, 208 – 240V (Continued)

Frame:	4					5			6		7			8			Delivery Code	Catalog Number	Price U.S. $
hp (I_H):	3/4	1	1-1/2	2	3	5 ①	5	7-1/2	10	15	20	25	30	40	50	60			
Choppers/Rectifiers																			
									1								W	**CP01367**	
										1							W	**CP01368**	
Diode/Thyristor Modules																			
											3	3	3				W	**PP01035**	
														3	3	3	W	**CP01268**	
Rectifying Boards																			
											1	1	1				W	**VB00242**	
														1	1	1	W	**VB00227**	

① 5 hp I_L only; has no corresponding I_H rated hp rating.

Table 40-250. 9000X Series Replacement Parts — FR4 – FR9 SPX9000 Drives, 380 – 500V

Frame:	4						5			6			7			8			9		Delivery Code	Catalog Number	Price U.S. $
hp (I_H):	1	1-1/2	2	3	5	7-1/2 ②	7-1/2	10	15	20	25	30	40	50	60	75	100	125	150	200			
Control Board																							
	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	W	**VB00252**	
Power Boards																							
	1																				FB	**VB00208-0003-5**	
		1																			FB	**VB00208-0004-5**	
			1																		FB	**VB00208-0005-5**	
				1																	FB	**VB00208-0007-5**	
					1																FB	**VB00208-0009-5**	
						1															FB	**VB00210-0012-5**	
							1														FB	**VB00213-0016-5**	
								1													FB	**VB00213-0022-5**	
									1												FB	**VB00213-0031-5**	
										1											FB	**VB00216-0038-5**	
											1										FB	**VB00216-0045-5**	
												1									FB	**VB00216-0061-5**	
													1								FB	**VB00219-0072-5**	
														1							FB	**VB00219-0087-5**	
															1						FB	**VB00219-0105-5**	
																1					FB	**VB00236-0140-5**	
																	1				FB	**VB00236-0168-5**	
																		1			FB	**VB00236-0205-5**	
Electrolytic Capacitors																							
	2	2	2	2																	W	**PP01000**	
					2	2															W	**PP01001**	
							2	2													W	**PP01002**	
									2												W	**PP01003**	
										2	2	2									W	**PP01004**	
													2	2	2	4	4	4	8	8	W	**PP01005**	
Cooling Fans																							
	1	1	1	1	1	1															W	**PP01060**	
							1	1	1												W	**PP01061**	
										1	1	1									W	**PP01062**	
													1	1	1						W	**PP01063**	
																1	1	1			FC	**PP01123** ③	
																			1	1	FC	**PP01080** ④	
	1	1	1	1	1	1															W	**PP01086**	
							1	1	1												FC	**PP01088**	
										1	1	1	1	1	1						W	**PP01049**	
																1	1	1			FC	**CP01180**	
																			1 ⑤	2	W	**PP01068**	
																			1	1	FC	**PP09051**	

② I_L only; has no corresponding I_H rated hp rating.
③ PP00061 capacitor not included in main fan; please order separately.
④ PP00011 capacitor not included in main fan; please order separately.
⑤ For FR9 NEMA Type 12 you need two PP01068 internal fans.

Discount Symbol **SS-2**

Table 40-250. 9000X Series Replacement Parts — FR4 – FR9 SPX9000 Drives, 380 – 500V (Continued)

Frame:	4						5			6			7			8			9		Delivery Code	Catalog Number	Price U.S. $
hp (I_H):	1	1-1/2	2	3	5	7-1/2 ①	7-1/2	10	15	20	25	30	40	50	60	75	100	125	150	200			
IGBT Modules																							
	1	1	1																		W	**CP01304**	
				1	1																W	**CP01305**	
						1	1														W	**CP01306**	
								1													W	**CP01307**	
									1												W	**CP01308**	
										1	1										W	**PP01022**	
												1									W	**PP01023**	
													1								W	**PP01024**	
														1							W	**PP01025**	
															1						W	**PP01029**	
																1					W	**PP01026**	
																	1	1			W	**PP01027**	
Chopper/Rectifiers																							
										1	1										W	**CP01367**	
												1									W	**CP01368**	
Diode/Thyristor Modules																							
													3	3	3						W	**PP01035**	
																3	3	3			W	**CP01268**	
																			3	3	W	**PP01037**	
Rectifying Boards																							
													1	1	1						W	**VB00242**	
																1	1	1			W	**VB00227**	
																			1	1	W	**VB00459**	
Rectifying Module Sub-assembly																							
																			1	1	W	**FR09810**	
Power Module Sub-assemblies																							
																			1		W	**FR09-150-4-ANS** ②	
																				1	W	**FR09-200-4-ANS** ②	

① I_L only; has no corresponding I_H rated hp rating.
② See **Table 40-254** for details.

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Discount Symbol. **SS-2**

Table 40-251. 9000X Series Replacement Parts — FR10 – FR12 SPX9000 Drives, 380 – 500V

Frame:	10			11			12			Delivery Code	Catalog Number	Price U.S. $
hp (I_H):	250	300	350	400	500	550	600	650	700			
Control Board												
	1	1	1	1	1	1	1	1	1	W	**VB00561**	
Shunt Boards												
	6									FC	**VB00537**	
		6								FC	**VB00497**	
			6				12	12	12	FC	**VB00498**	
				9						FC	**VB00538**	
					9					FC	**VB00513**	
						9				FC	**VB00514**	
Driver Boards												
				3	3	3				FC	**VB00489**	
	1	1	1				2	2	2	FC	**VB00487**	
Driver Adapter Board												
	1	1	1				2	2	2	FC	**VB00330**	
ASIC Board												
	1	1	1	1	1	1	2	2	2	FC	**VB00451**	
Feedback Interface Board												
							2	2	2	FC	**VB00448**	
Star Coupler Board												
							1	1	1	FC	**VB00336**	
Power Modules												
	1	1	1	2	2	2	2	2	2	FC	**FR10820** [1]	
	2	2	2							FC	**FR10828**	
	1									FC	**FR10-250-4-ANS** [2]	
		1								FC	**FR10-300-4-ANS** [2]	
			1				2	2	2	FC	**FR10-350-4-ANS** [2]	
				3						FC	**FR11-400-4-ANS** [2]	
					3					FC	**FR11-500-4-ANS** [2]	
						3				FC	**FR11-550-4-ANS** [2]	
Electrolytic Capacitors												
	2	2	2	3	3	3	4	4	4	FC	**PP00060**	
	12	12	12	18	18	18	24	24	24	FC	**PP01005**	
Fuses												
	1	1	1	1	1	1	2	2	2	FC	**PP01094**	
	2	2	2	2	2	2	4	4	4	FC	**PP01095**	
Cooling Fans and Isolation Transformers												
	2	2	2	3	3	3	4	4	4	FC	**VB00299**	
	2	2	2	3	3	3	4	4	4	FC	**PP01080** [3]	
	2	2	2				4	4	4	FC	**PP01068**	
	1	1	1	1	1	1	2	2	2	FC	**PP01096**	
	1	1	1				2	2	2	FC	**FR10844**	
	1	1	1	3	3	3	2	2	2	FC	**FR10845**	
	1	1	1				2	2	2	FC	**FR10846**	
	1	1	1	3	3	3	2	2	2	FC	**FR10847**	
Rectifying Board												
	1	1	1	2	2	2	2	2	2	FC	**VB00459**	

[1] Rectifying board not included.
[2] See **Table 40-254** for details.
[3] PP00060 capacitor not included in main fan; please order separately.

Discount Symbol **SS-2**

Table 40-252. 9000X Series Replacement Parts — FR6 – FR9 SPX9000 Drives, 525 – 690V

Frame:	6									7		8			9				Delivery Code	Catalog Number	Price U.S. $
hp (I_H):	2	3	5 ①	5	7-1/2	10	15	20	25	30	40	50	60	75	100	125	150	200 ①			
Control Board																					
	1	1	1	1	1	1	1	1	1	1	1					1	1	1	W	**VB00561**	
Driver Board																					
	1																		FB	**VB00404-0004-6**	
		1																	FB	**VB00404-0005-6**	
			1																FB	**VB00404-0007-6**	
				1															FB	**VB00404-0010-6**	
					1														FB	**VB00404-0013-6**	
						1													FB	**VB00404-0018-6**	
							1												FB	**VB00404-0022-6**	
								1											FB	**VB00404-0027-6**	
									1										FB	**VB00404-0034-6**	
Power Boards																					
	1	1	1	1	1	1	1	1	1										FB	**VB00414**	
										1									FB	**VB00419-0041-6**	
											1								FB	**VB00419-0052-6**	
												1							FB	**VB00422-0062-6**	
													1						FB	**VB00422-0080-6**	
														1					FB	**VB00422-0100-6**	
Power Modules																					
															1				FC	**FR09-100-5-ANS** ②	
																1			FC	**FR09-125-5-ANS** ②	
																	1		FC	**FR09-150-5-ANS** ②	
																		1	FC	**FR09-175-5-ANS** ②	
Electrolytic Capacitors																					
	2	2	2	2	2	2	2	2	2										FC	**PP01093**	
										2	2	4	4		8	8	8	8	FC	**PP01041**	
														4					FC	**PP01040**	
Fuses																					
												1	1	1	1	1	1	1	W	**PP01094**	
												2	2	2	2	2	2	2	W	**PP01095**	
Cooling Fans																					
	1	1	1	1	1														W	**PP01061**	
						1	1	1	1										W	**PP01062**	
										1	1								W	**PP01063**	
												1	1	1					FC	**PP01123**	
	1	1	1	1	1	1	1	1	1	1	1								W	**PP01049**	
												1	1	1					FC	**CP01180**	
															1	1	1	1 ③	W	**PP01068**	
															1	1	1	1	FC	**PP01080**	
Fan Power Supply																					
																1	1	1	FC	**VB00299**	
IGBT Modules																					
	3	3	3	3	3	3	3	3	3										FC	**PP01091**	
										1	1								FC	**PP01089**	
												1	1	1					FC	**PP01127**	
IGBT/Diode (Brake)																					
	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	FC	**PP01040**	
Diode Module																					
	1	1	1	1	1	1	1	1	1										FC	**PP01092**	
Diode/Thyristor Modules																					
										3	3								FC	**PP01071**	
															3	3	3	3	FC	**PP01072**	
Rectifying Boards																					
										1	1								FC	**VB00442**	
															1	1	1	1	FC	**VB00460**	
Rectifying Module Sub-assemblies																					
																1	1	1	W	**FR09810**	
																1	1	1	FC	**FR09811**	

① I_L only; has no corresponding I_H rated hp rating.
② See **Table 40-254** for details.
③ For NEMA Type 12, two PP01068 internal fans are needed.

Discount Symbol **SS-2**

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Table 40-253. 9000X Series Replacement Parts — FR10 – FR12 SPX9000 Drives, 525 – 690V

Frame:	10			11			12			Delivery Code	Catalog Number	Price U.S. $
hp (I_H):	200	250	300	400	450	500	550	600	700			
Component Boards												
	1	1	1	1	1	1	1	1	1	W	**VB00561**	
	1	1	1	1	1	1	2	2	2	FC	**VB00451**	
	6									FC	**VB00545**	
		6								FC	**VB00510**	
			6				12	12	12	FC	**VB00511**	
	1	1	1				2	2	2	FC	**VB00330**	
	1	1	1				2	2	2	FC	**VB00487**	
				3	3	3				FC	**VB00489**	
				9						FC	**VB00546**	
					9					FC	**VB00547**	
						9				FC	**VB00512**	
							2	2	2	FC	**VB00448**	
							1	1	1	FC	**VB00336**	
Power Modules												
	1	1	1	2	2	2	2	2	2	FC	**FR10821** ①	
	2	2	2							FC	**FR10829**	
	1									FC	**FR10-200-5-ANS** ②	
		1								FC	**FR10-250-5-ANS** ②	
			1				2	2	2	FC	**FR10-300-5-ANS** ②	
				3						FC	**FR11-400-5-ANS** ②	
					3					FC	**FR11-450-5-ANS** ②	
						3				FC	**FR11-500-5-ANS** ②	
Electrolytic Capacitors												
	2	2	2	3	3	3	4	4	4	FC	**PP00060**	
	12	12	12	18	18	18	24	24	24	FC	**PP01099**	
Fuses												
	1	1	1	1	1	1	2	2	2	FC	**PP01094**	
	2	2	2	2	2	2	4	4	4	FC	**PP01095**	
Cooling Fans and Isolation Transformers												
	2	2	2	3	3	3	4	4	4	FC	**VB00299**	
	2	2	2	3	3	3	4	4	4	FC	**PP01080** ③	
	2	2	2				4	4	4	FC	**PP01068**	
	1	1	1	1	1	1	2	2	2	FC	**PP01096**	
	1	1	1				2	2	2	FC	**FR10844**	
	1	1	1	3	3	3	2	2	2	FC	**FR10845**	
	1	1	1				2	2	2	FC	**FR10846**	
	1	1	1	3	3	3	2	2	2	FC	**FR10847**	
Fan Power Supply												
							1	1	1	FC	**VB00299**	
Rectifying Boards												
	1	1	1	2	2	2	2	2	2	FC	**VB00460**	

① Rectifying board not included.
② See **Table 40-254** for details.
③ PP00060 capacitor not included in main fan; please order separately.

Table 40-254. Power Module Catalog Number Matrix

FR10 – 000 – 4 – A N S

- **Frame Code** (FR10)
- **Horsepower** (000): Example: **150** = 150 hp (See **Table 40-200** on **Page 40-134**.)
- **Voltage** (4): **4** = 380 – 500V; **5** = 525 – 690V
- **Cooling Type** (A): **A** = Air
- **Brake Option** (N): **N** = No Brake Chopper; **B** = Brake Chopper
- **Varnishing** (S): **S** = Standard; **V** = Varnished

Discount Symbol **SS-2**

Contents



HVX9000 Open Drives

Product Description

Cutler-Hammer® HVX9000 Series Adjustable Frequency Drives by Eaton's electrical business are the next generation of drives specifically engineered for HVAC, pump and fluid control applications. The power unit makes use of the most sophisticated semiconductor technology and a highly modular construction that can be flexibly adapted to the customer's needs.

The input and output configuration (I/O) is designed with modularity in mind. The I/O is compromised of option cards, each with its own input and output configuration. The control module is designed to accept a total of five of these cards. The cards contain not only normal analog and digital inputs but also fieldbus cards.

These drives continue the tradition of robust performance, and raise the bar on features and functionality, ensuring the best solution at the right price.

Features and Benefits

- Robust design — proven 500,000 hours MTBF
- Integrated 3% line reactors standard on drives from FR4 through FR9
- EMI/RFI Filters standard on all drives from FR4 through FR9
- HAND/OFF/AUTO and DRIVE/ BYPASS selector on keypad simplifies control
- Additional I/O and communication cards provide plug and play functionality
- Copy/Paste function allows transfer of parameter settings from one drive to the next
- Keypad can display up to three monitored parameters simultaneously
- Hand-held Auxiliary Power Supply allows programming/monitoring of control module without applying power to the drive
- NEMA Type 1 and NEMA Type 12 enclosures available
- Standard NEMA Type 12 keypad on all drives
- Simplified operating menu allows for typical programming changes, while programming mode provides control of everything
- Accommodates a wide selection of expander boards and adapter boards
- UL Listed
- Quickstart wizard built into programming of drive ensures a smooth start-up
- The HVX can be flexibly adapted to a variety of needs using our pre-installed program
- I/O connections with simple quick connection terminals
- Control logic can be powered from an external auxiliary control panel, internal drive functions and fieldbus if necessary
- Standard option board configuration includes an A9 I/O board and an A2 relay output board installed in slots A and B

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Technical Data and Specifications

Table 40-255. HVX9000 Specifications

Description	Specification
Input Ratings	
Input Voltage (V_{in})	+10% / -15%
Input Frequency (f_{in})	50/60 Hz (variation up to 45 – 66 Hz)
Connection to Power	Once per minute or less (typical operation)
Short Circuit Withstand Rating	100 kAIC
Output Ratings	
Output Voltage	0 to V_{in}
Continuous Output Current	Ambient temperature max. +104°F(+40°C)
Overload Current	110% (1 min./10 min.)
Output Frequency	0 to 320 Hz
Frequency Resolution	.01 Hz
Control Characteristics	
Control Method	Frequency Control (V/f) Open Loop Sensorless Vector Control
Switching Frequency	Adjustable with Parameter 2.6.9 1 – 40 hp: 1 to 16 kHz; default 10 kHz 50 – 75 hp: 1 to 10 kHz; default 3.6 kHz
Frequency Reference	Analog Input: Resolution .1% (10-bit), accuracy ± 1% Panel Reference: Resolution .01 Hz
Field Weakening Point	30 to 320 Hz
Acceleration Time	0 to 3000 sec.
Deceleration Time	0 to 3000 sec.
Braking Torque	DC brake: 30% x T_n (without brake option)
Ambient Conditions	
Ambient Operating Temperature	14°F (-10°C), no frost to 104°F (+40°C)
Storage Temperature	-40°F (-40°C) to 158°F (70°C)
Relative Humidity	0 to 95% RH, noncondensing, non-corrosive, no dripping water
Air Quality	Chemical vapors: IEC 721-3-3, unit in operation, class 3C2; Mechanical particles: IEC 721-3-3, unit in operation, class 3S2
Altitude	100% load capacity (no derating) up to 3280 ft. (1000m); 1% derating for each 328 ft. (100m) above 3280 ft. (1000m); max. 9842 ft. (3000m)
Vibration	EN 50178, EN 60068-2-6; 5 to 50 Hz, Displacement amplitude 1 mm (peak) at 3 to 15.8 Hz, Max. acceleration amplitude 1G at 15.8 to 150 Hz
Shock	EN 50178, EN 60068-2-27 UPS Drop test (for applicable UPS weights) Storage and shipping: max. 15G, 11 ms (in package)
Enclosure Class	NEMA Type 1/IP21 or NEMA Type 12/IP54

Description	Specification
Standards	
Product	IEC 61800-2
Safety	UL 508C
EMC (at default settings)	Immunity: Fulfills all EMC immunity requirements; Emissions: EN 61800-3, LEVEL H
Control Connections	
Analog Input Voltage	0 to 10V, R = 200Ω differential (-10 to 10V joystick control) Resolution .1%; accuracy ±1%
Analog Input Current	0(4) to 20 mA; R_i - 250Ω differential
Digital Inputs (6)	Positive or negative logic; 18 to 24V DC
Auxiliary Voltage	+24V ±15%, max. 250 mA
Output Reference Voltage	+10V +3%, max. load 10 mA
Analog Output	0(4) to 20 mA; R_L max. 500Ω; Resolution 10 bit; Accuracy ±2%
Digital Outputs	Open collector output, 50 mA/48V
Relay Outputs	2 programmable Form C relay outputs Switching capacity: 24V DC / 8A, 250V AC / 8A, 125V DC / 0.4A
Protections	
Overcurrent Protection	Yes
Overvoltage Protection	Yes
Undervoltage Protection	Yes
Earth Fault Protection	In case of earth fault in motor or motor cable, only the frequency converter is protected
Input Phase Supervision	Trips if any of the input phases are missing
Motor Phase Supervision	Trips if any of the output phases are missing
Overtemperature Protection	Yes
Motor Overload Protection	Yes
Motor Stall Protection	Yes
Motor Underload Protection	Yes
Short Circuit Protection	Yes (Of the +24V and +10V Reference Voltages)

Catalog Number Selection

Table 40-256. Adjustable Frequency Drive Catalog Numbering System

HVX 010 A 1 – 4 A 1 B 1 _ _ _ _ _ _

Product Family
HVX = HVAC Drive Family

Horsepower Rating (I_L)		
001 = 1	**020** = 20	**125** = 125
F15 = 1-1/2	**025** = 25	**150** = 150
002 = 2	**030** = 30	**200** = 200
003 = 3	**040** = 40	**250** = 250
005 = 5	**050** = 50	**300** = 300
007 = 7-1/2	**060** = 60	**400** = 400
010 = 10	**075** = 75	
015 = 15	**100** = 100	

Software Series
A = Standard Software

Enclosure ③	
0 = Chassis **1** = NEMA Type 1	**2** = NEMA Type 12

Voltage Rating
2 = 230 (208 – 240) V **4** = 480 (380 – 500) V **5** = 575 (525 – 690) V

Keypad
A = Alphanumeric

Input Options ①
1 = 3-phase, EMC H **2** = 3-phase, EMC N **4** = 3-phase, EMC L

Brake Chopper Options ②
N = No Brake Chopper Circuit **B** = Internal Brake Chopper Circuit

Board Modifications
1 = Standard Boards

Options
Options appear in alphabetical order.
Extended I/O Card Options
B1 = 6 DI, 1 ext +24V DC/EXT +24V DC **B2** = 1 RO (NC/NO), 1 RO (NO), 1 Therm **B4** = 1 AI (mA isolated), 2 AO (mA isolated) **B5** = 1 ext +24V DC/ EXT +24V DC, 3 RO (NO) **B8** = 1 ext +24V DC/EXT +24V DC, 3 Pt100 **B9** = 1 RO (NO), 5 DI 42 – 240V AC Input
Communication Cards
CA = Johnson Controls N2 **CB** = Siemens Apogee FLN **CJ** = BACnet **C2** = Modbus **C4** = LonWorks **C8** = Modbus (D9 Type Connector) **D3** = RS-232 with D9 Connection

① All 230V Drives and 480V Drives up to 250 hp (I_L) are only available with Input Option **1.** 480V Freestanding Drives are available with Input Option **4** (EMC Level L). **2.** 575V Drives up to 200 hp (I_L) are only available with Input Option **4** (EMC Level L).

② 480V Drives up to 40 hp (I_L) are only available with Brake Chopper Option **B**. 480V Drives 50 hp (I_L) or larger are only available with Brake Chopper Option **N**. 230V Drives up to 20 hp (I_L) are only available with Brake Chopper Option **B**. 575V Drives are standard without Brake Chopper Option (**N**).

③ 480V Drives 300 – 600 hp (I_L) are available with enclosure style **0** (Chassis). 480V FR10 Freestanding Drives are available with enclosure style **1** (NEMA Type 1) or **2** (NEMA Type 12). FR11 Freestanding Drives are only available with enclosure style **1** (NEMA Type 1).

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Product Selection

230V HVX9000 Drives

Table 40-257. 208 – 240V, NEMA Type 1 Drive

Frame Size	Delivery Code	hp (I_L)	Current (I_L)	Catalog Number	Price U.S. $
FR4	F1	1 1-1/2 2 3	4.8 6.6 7.8 11	**HVX001A1-2A1B1** **HVXF15A1-2A1B1** **HVX002A1-2A1B1** **HVX003A1-2A1B1**	.
FR5	F1	5 7-1/2 10	17.5 25 31	**HVX005A1-2A1B1** **HVX007A1-2A1B1** **HVX010A1-2A1B1**	
FR6	F1	15 20	48 61	**HVX015A1-2A1B1** **HVX020A1-2A1B1**	
FR7	F1	25 30 40	75 88 114	**HVX025A1-2A1N1** **HVX030A1-2A1N1** **HVX040A1-2A1N1**	
FR8	F1	50 60 75	140 170 205	**HVX050A1-2A1N1** **HVX060A1-2A1N1** **HVX075A1-2A1N1**	

Table 40-258. 208 – 240V, NEMA Type 12 Drive

Frame Size	Delivery Code	hp (I_L)	Current (I_L)	Catalog Number	Price U.S. $
FR4	F1	1 1-1/2 2 3	4.8 6.6 7.8 11	**HVX001A2-2A1B1** **HVXF15A2-2A1B1** **HVX002A2-2A1B1** **HVX003A2-2A1B1**	
FR5	F1	5 7-1/2 10	17.5 25 31	**HVX005A2-2A1B1** **HVX007A2-2A1B1** **HVX010A2-2A1B1**	
FR6	F1	15 20	48 61	**HVX015A2-2A1B1** **HVX020A2-2A1B1**	
FR7	F1	25 30 40	75 88 114	**HVX025A2-2A1N1** **HVX030A2-2A1N1** **HVX040A2-2A1N1**	
FR8	FP	50 60 75	140 170 205	**HVX050A2-2A1N1** **HVX060A2-2A1N1** **HVX075A2-2A1N1**	

480V HVX9000 Drives

Table 40-259. 380 – 500V, NEMA Type 1 Drive

Frame Size	Delivery Code	hp (I_L)	Current (I_L)	Catalog Number	Price U.S. $
FR4	F1	1-1/2 2 3 5 7-1/2	3.3 4.3 5.6 7.6 12	**HVXF15A1-4A1B1** **HVX002A1-4A1B1** **HVX003A1-4A1B1** **HVX005A1-4A1B1** **HVX007A1-4A1B1**	
FR5	F1	10 15 20	16 23 31	**HVX010A1-4A1B1** **HVX015A1-4A1B1** **HVX020A1-4A1B1**	
FR6	F1	25 30 40	38 46 61	**HVX025A1-4A1B1** **HVX030A1-4A1B1** **HVX040A1-4A1B1**	
FR7	F1	50 60 75	72 87 105	**HVX050A1-4A1N1** **HVX060A1-4A1N1** **HVX075A1-4A1N1**	
FR8	F1	100 125 150	140 170 205	**HVX100A1-4A1N1** **HVX125A1-4A1N1** **HVX150A1-4A1N1**	
FR9	F1	200 250	261 300	**HVX200A1-4A1N1** **HVX250A1-4A1N1**	

Discount Symbol **SS-6**

Table 40-260. 380 – 500V, NEMA Type 1 Freestanding Drive

Frame Size	Delivery Code	hp (I_L)	Current (I_L)	Catalog Number	Price U.S. $
FR10	W FP W	300 350 400	385 460 520	**HVX300A1-4A4N1** **HVX350A1-4A4N1** **HVX400A1-4A4N1**	
FR11	FP FP FP	500 550 600	590 650 730	**HVX500A1-4A4N1** **HVX550A1-4A4N1** **HVX600A1-4A4N1**	

Note: Integrated fuses as standard. Limited option selection available; 115V Transformer (KB), Light Kit (L1), HOA (K4), Speed Potentiometer w/HOA (K2), Disconnect Switch (P2). See Freestanding Option Selection on **Page 40-174**.

Table 40-261. 380 – 500V, NEMA Type 12 Drive

Frame Size	Delivery Code	hp (I_L)	Current (I_L)	Catalog Number	Price U.S. $
FR4	F1	1-1/2 2 3 5 7-1/2	3.3 4.3 5.6 7.6 12	**HVXF15A2-4A1B1** **HVX002A2-4A1B1** **HVX003A2-4A1B1** **HVX005A2-4A1B1** **HVX007A2-4A1B1**	
FR5	F1	10 15 20	16 23 31	**HVX010A2-4A1B1** **HVX015A2-4A1B1** **HVX020A2-4A1B1**	
FR6	F1	25 30 40	38 46 61	**HVX025A2-4A1B1** **HVX030A2-4A1B1** **HVX040A2-4A1B1**	
FR7	F1	50 60 75	72 87 105	**HVX050A2-4A1N1** **HVX060A2-4A1N1** **HVX075A2-4A1N1**	
FR8	F1	100 125 150	140 170 205	**HVX100A2-4A1N1** **HVX125A2-4A1N1** **HVX150A2-4A1N1**	
FR9	F1	200 250	261 300	**HVX200A2-4A1N1** **HVX250A2-4A1N1**	

Table 40-262. 380 – 500V, NEMA Type 12 Freestanding Drive

Frame Size	Delivery Code	hp (I_L)	Current (I_L)	Catalog Number	Price U.S. $
FR10	FP FP FP	300 350 400	385 460 520	**HVX300A2-4A4N1** **HVX350A2-4A4N1** **HVX400A2-4A4N1**	

Note: Integrated fuses as standard. Limited option selection available; 115V Transformer (KB), Light Kit (L1), HOA (K4), Speed Potentiometer w/HOA (K2), Disconnect Switch (P2). See Freestanding Option Selection on **Page 40-174**.

Table 40-263. 380 – 500V, Open Chassis Drive

Frame Size	Delivery Code	hp (I_L)	Current (I_L)	Catalog Number	Price U.S. $
FR10 ①	F1	300 350 400	385 460 520	**HVX300A0-4A2N1** **HVX350A0-4A2N1** **HVX400A0-4A2N1**	
FR11	F1 F1 F1	500 550 600	590 650 1300	**HVX500A0-4A2N1** **HVX550A0-4A2N1** **HVX600A0-4A2N1**	

① FR10 includes 3% line reactor, but it is not integrated to chassis.

Discount Symbol **SS-6**

575V HVX9000 Drives

Table 40-264. 525 – 690V, NEMA Type 1 Drive

Frame Size	Delivery Code	hp (I_L)	Current (I_L)	Catalog Number	Price U.S. $
FR6	F1	3 5 7-1/2 10 15 20 25 30	4.5 7.5 10 13.5 18 22 27 34	**HVX003A1-5A4N1** **HVX005A1-5A4N1** **HVX007A1-5A4N1** **HVX010A1-5A4N1** **HVX015A1-5A4N1** **HVX020A1-5A4N1** **HVX025A1-5A4N1** **HVX030A1-5A4N1**	
FR7	F1	40 50	41 52	**HVX040A1-5A4N1** **HVX050A1-5A4N1**	
FR8	F1	60 75 100	62 80 100	**HVX060A1-5A4N1** **HVX075A1-5A4N1** **HVX100A1-5A4N1**	
FR9	F1	125 150 200	125 144 208	**HVX125A1-5A4N1** **HVX150A1-5A4N1** **HVX200A1-5A4N1**	

Table 40-265. 525 – 690V, NEMA Type 12 Drive

Frame Size	Delivery Code	hp (I_L)	Current (I_L)	Catalog Number	Price U.S. $
FR6	F1	3 5 7-1/2 10 15 20 25 30	4.5 7.5 10 13.5 18 22 27 34	**HVX003A2-5A4N1** **HVX005A2-5A4N1** **HVX007A2-5A4N1** **HVX010A2-5A4N1** **HVX015A2-5A4N1** **HVX020A2-5A4N1** **HVX025A2-5A4N1** **HVX030A2-5A4N1**	
FR7	MP28	40 50	41 52	**HVX040A2-5A4N1** **HVX050A2-5A4N1**	
FR8	MP28	60 75 100	62 80 100	**HVX060A2-5A4N1** **HVX075A2-5A4N1** **HVX100A2-5A4N1**	
FR9	MP28	125 150 200	125 144 208	**HVX125A2-5A4N1** **HVX150A2-5A4N1** **HVX200A2-5A4N1**	

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9000X Series Option Board Kits

The 9000X Series drives can accommodate a wide selection of expander and adapter option boards to customize the drive for your application needs. The drive's control unit is designed to accept a total of five option boards (see **Figure 40-84**).

The 9000X Series factory installed standard board configuration includes an A9 I/O board and an A2 relay output board, which are installed in slots A and B.

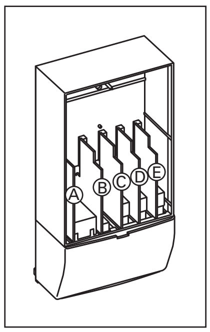


Figure 40-84. 9000X Series Option Boards

Table 40-266. Option Board Kits

Option Kit Description ②	Allowed Slot Locations ①	Field Installed		Factory Installed	
		Catalog Number	Price U.S. $	Option Designator	Adder U.S. $
Standard I/O Cards (See Figure 40-84)					
2 RO (NC/NO) 6 DI, 1 DO, 2 AI, 1 AO, 1 +10V DC ref, 2 ext +24V DC/ EXT +24V DC	B A	**OPTA2** **OPTA9**		— —	
Extended I/O Card Options					
6 DI, 1 ext +24V DC/EXT +24V DC 1 RO (NC/NO), 1 RO (NO), 1 Therm 1 AI (mA isolated), 2 AO (mA isolated) 1 ext +24V DC/ EXT +24V DC, 3 RO (NO) 1 ext +24V DC/EXT +24V DC, 3 Pt100 1 RO (NO), 5 DI 42 – 240V AC Input	B, C, **D**, E B, C, **D**, E C, **D** C, **D** B, C, **D**, E B, C, **D**, E	**OPTB1** **OPTB2** **OPTB4** **OPTB5** **OPTB8** **OPTB9**		**B1** **B2** **B4** **B5** **B8** **B9**	
Communication Cards ③④					
Modbus Johnson Controls N2 LonWorks Modbus (D9 Type Connector) Siemens Apogee FLN BACnet RS-232 with D9 Connection	D, **E** D, **E** D, **E** D, **E** D, **E** D, **E**	**OPTC2** **OPTC2** **OPTC4** **OPTC8** **OPTCB** **OPTCJ** **OPTD3**		**C2** **CA** **C4** **C8** **CB** **CJ** **D3**	
Keypad					
9000X Series HAND/OFF/AUTO Keypad	—	**KEYPAD-HOA**		**—**	
9000X Series Remote Mount Keypad Unit (Keypad not included, includes 10 ft. cable, keypad holder, mounting hardware)	—	**OPTRMT-KIT-9000X**		**—**	

① Option card must be installed in one of the slots listed for that card. Slot indicated in **Bold** is the preferred location.
② AI = Analog Input; AO = Analog Output, DI = Digital Input, DO = Digital Output, RO = Relay Output
③ Only one Communication Module can be installed at a time.
④ OPTC2 is a multi-protocol option card.

Discount Symbol **SS-6**

Johnson Controls Metasys™ N2 Network Communications

The OPTC2 fieldbus board provides communication between the 9000X Drive and a Johnson Controls Metasys™ N2 network. With this connection, the drive can be controlled, monitored and programmed from the Metasys system. The N2 fieldbus is available as a factory installed option and as a field installable kit.

BACnet Network Communications

The BACnet Network Card OPTCJ is used for connecting the 9000X Drive to BACnet networks. It includes a 5.08 mm pluggable connector. Data transfer is Master-Slave/Token Passing (MS/TP) RS-485. This interface uses a collection of 30 Binary Value Objects (BVOs) and 35 Analog Value Objects (AVOs) to communicate drive parameters. The card supports 9.6, 19.2 and 38.4 Kbaud communication speeds and supports network addresses 1 – 127.

Modbus RTU Network Communications

The Modbus Network Card OPTC2 is used for connecting the 9000X Drive as a slave on a Modbus network. The interface is connected by a 9-pin DSUB connector (female) and the baud rate ranges from 300 to 19200 baud. Other communication parameters include an address range from 1 to 247; a parity of None, Odd or Even; and the stop bit is 1.

LonWorks Network Communications

The LonWorks Network Card OPTC4 is used for connecting the 9000X Drive on a LonWorks network. This interface uses Standard Network Variable Types (SNVT) as data types. The channel connection is achieved using a FTT-10A Free Topology transceiver via a single twisted transfer cable. The communication speed with LonWorks is 78 kBits/s.

Accessories

Drive Demo and Power Supply

Table 40-267. Drive Demo and Power Supply

Description	Catalog Number	Price U.S. $
HVX9000 Drive Demo	**9000HVXDEMO**	
Hand Held 24V Auxiliary Power Supply — used to supply power to the control module in order to perform keypad programming before the drive is connected to line voltage	**9000XAUX24V**	

Discount Symbol **SS-6**

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NEMA Type 12 Conversion Kit

The NEMA Type 12 kit option is used to convert a NEMA Type 1 to a NEMA Type 12 drive. The NEMA Type 12 Kit consists of a metal drive shroud, fan kit for some frames, adapter plate and plugs.

Flange Kits

Flange Kit Type 12

The flange kit is utilized when the power section is mounted through the back panel of an enclosure. Includes flange mount brackets and NEMA Type 12 fan components. Metal shroud not included.

Table 40-268. Flange Kit Type 12 — Frames 4, 5 and 6 ①

Frame Size	Delivery Code	Catalog Number	Price U.S. $
FR4	W	**OPTTHRFR4**	
FR5	W	**OPTTHRFR5**	
FR6	W	**OPTTHRFR6**	

① For installation of a NEMA Type 1 drive into a NEMA Type 12 oversized enclosure.

Flange Kit Type 1

Flange kits for NEMA Type 1 enclosure drive rating determined by rating of drive.

Table 40-269. Flange Kit Type 1 — Frames 4 – 9 ②

Frame Size	Delivery Code	Catalog Number	Price U.S. $
FR4	FP	**OPTTHR4**	
FR5	FP	**OPTTHR5**	
FR6	FP	**OPTTHR6**	
FR7	FP	**OPTTHR7**	
FR8	FP	**OPTTHR8**	
FR9	FP	**OPTTHR9**	

② For installation of a NEMA Type 1 drive into a NEMA Type 1 oversized enclosure.

Flange Kit Type 12

Flange kits for NEMA Type 12 enclosure drive rating determined by rating of drive.

Table 40-270. Flange Kit Type 12 — Frames 4 – 9 ③

Frame Size	Delivery Code	Catalog Number	Price U.S. $
FR4	FP	**OPTTHR4**	
FR5	FP	**OPTTHR5**	
FR6	FP	**OPTTHR6**	
FR7	FP	**OPTTHR7**	
FR8	FP	**OPTTHR8**	
FR9	FP	**OPTTHR9**	

③ For installation of a NEMA Type 12 drive into a NEMA Type 12 oversized enclosure.

Table 40-271. NEMA Type 12 Conversion Kit

Frame Size	Delivery Code	Approximate Dimensions in Inches (mm)			Approximate Weight in Lb. (kg)	Catalog Number	Price U.S. $
		Length	Width	Height	Weight		
FR4	W	13 (330)	7 (178)	4 (102)	4 (1.8)	**OPTN12FR4**	
FR5	W	16 (406)	8 (203)	7 (178)	5 (2.3)	**OPTN12FR5**	
FR6	W	21 (533)	10 (254)	5 (127)	7 (3.2)	**OPTN12FR6**	

Control/Communication Option Descriptions

Table 40-272. Available Control/Communications Options

Option	Description	Option Type
K2	**Door-Mounted Speed Potentiometer with HOA Selector Switch** — Provides the HVX9000 with the ability to start/stop and adjust the speed reference from door-mounted control devices or remotely from customer supplied inputs. In HAND position, the drive will start and the speed is controlled by the door-mounted speed potentiometer. The drive will be disabled in the OFF position. When AUTO is selected, the drive run and speed control commands are via user-supplied dry contact and 4 – 20 mA signal.	Control
K4	**HAND/OFF/AUTO Switch for Non-bypass Configurations** — Provides a three-position selector switch that allows the user to select either a Hand or Auto mode of operation. Hand mode is defaulted to keypad operation, and Auto mode is defaulted to control from an external terminal source. These modes of operation can be configured via programming to allow for alternate combinations of start and speed sources. Start and speed sources include Keypad, I/O and FieldBus.	Control
KB	**115V Control Transformer – 550 VA** — Provides a fused control power transformer with additional 550 VA at 115V for customer use.	Control
L1	**Power On and Fault Pilot Lights** — Provides a white power on light that indicates power to the enclosed cabinet and a red fault light indicates a drive fault has occurred.	Light
P2	**Disconnect Switch** — Disconnect switch option is applicable only with NEMA Type 1 and NEMA Type 12 Freestanding drives. Allows a convenient means of disconnecting the HVX9000 from the line, and the operating mechanism can be padlocked in the OFF position. This is factory-mounted in the enclosure.	Input

HVX Freestanding Options

Table 40-273. 480V and 690V Control Options

Catalog Number Suffix ➡	Door-Mounted Speed Potentiometer with HOA Selector Switch	HAND/OFF/AUTO Switch (22 mm)	115 Volt Control Transformer 550 VA
	K2	K4	KB
hp	Adder U.S. $	Adder U.S. $	Adder U.S. $
300 – 600			

Table 40-274. Input Options

Catalog Number Suffix ➡	Disconnect Switch
	P2 ④
hp	Adder U.S. $
300	
350	
400	
500	
550	
600	

④ Applicable with FR10 and FR11 Freestanding designs only.

Table 40-275. 480V and 690V Light Options

Catalog Number Suffix ➡	Power On/ Fault Pilot Lights
	L1
hp	Adder U.S. $
300 – 600	

Discount Symbol SS-6

Dimensions

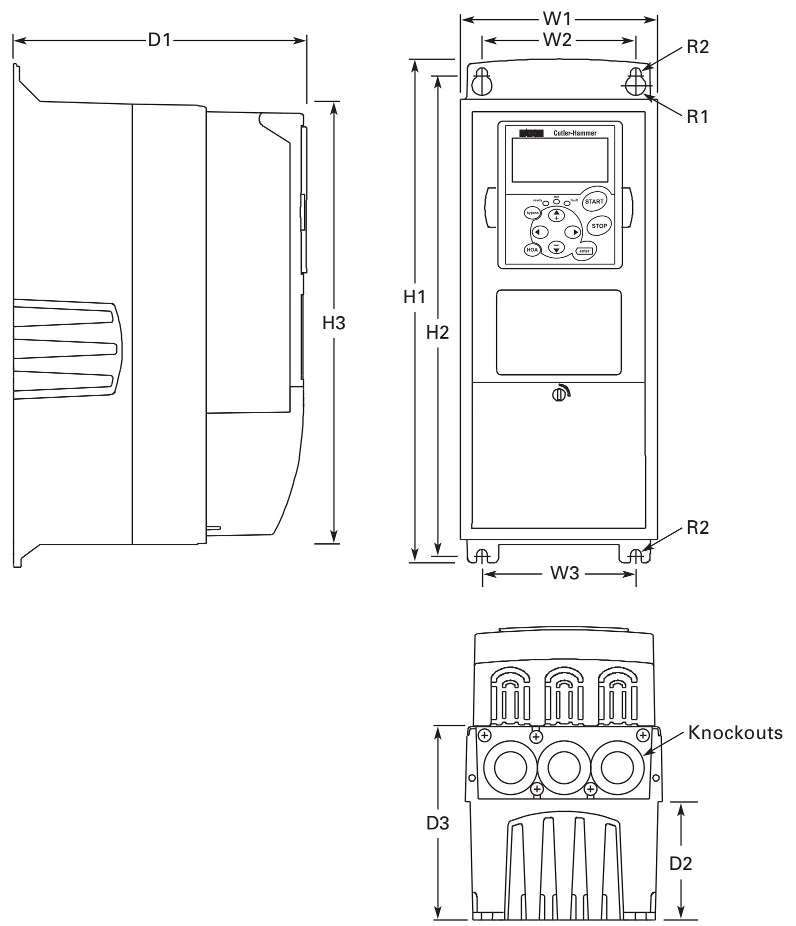


Figure 40-85. NEMA Type 1 and NEMA Type 12 HVX9000 Drive Dimensions, FR4, FR5 and FR6

Table 40-276. HVX9000 Drive Dimensions

Frame Size	Voltage	hp (I_L)	Approximate Dimensions in Inches (mm)											Weight Lbs. (kg)	Knockouts @ Inches (mm)
			H1	H2	H3	D1	D2	D3	W1	W2	W3	R1 dia.	R2 dia.		N1 (O.D.)
FR4	230V	1 – 3	12.9 (327)	12.3 (313)	11.5 (292)	7.5 (190)	3.0 (77)	5.0 (126)	5.0 (128)	3.9 (100)	—	.5 (13)	.3 (7)	11.0 (5)	3 @ 1.1 (28)
	480V	1-1/2 – 7-1/2													
FR5	230V	5 – 10	16.5 (419)	16.0 (406)	15.3 (389)	8.4 (214)	3.9 (100)	5.8 (148)	5.6 (143)	3.9 (100)	—	.5 (13)	.3 (7)	17.9 (8)	2 @ 1.5 (37) 1 @ 1.1 (28)
	480V	10 – 20													
FR6	230V	15 – 20	22.0 (558)	21.3 (541)	20.4 (519)	9.3 (237)	4.2 (105)	6.5 (165)	7.6 (195)	5.8 (148)	—	.6 (15.5)	.4 (9)	40.8 (19)	3 @ 1.5 (37)
	480V	25 – 40													

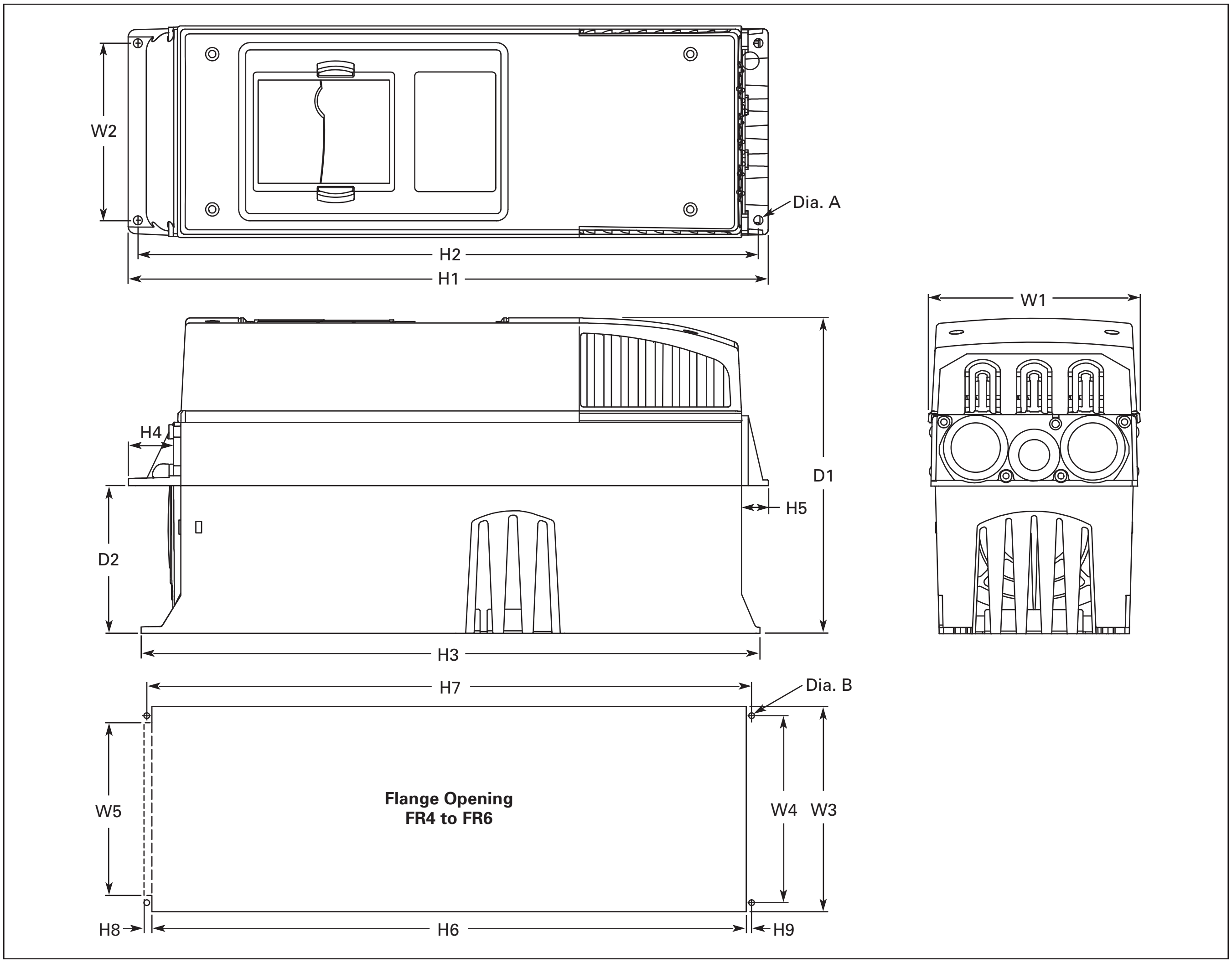


Figure 40-86. HVX9000 Dimensions, NEMA Type 1 and NEMA Type 12 with Flange Kit, FR4, FR5 and FR6

Table 40-277. Dimensions for HVX9000, FR4, FR5 and FR6 with Flange Kit

Frame Size	Approximate Dimensions in Inches (mm)								
	W1	W2	H1	H2	H3	H4	H5	D1	D2	Dia. A
FR4	5.0 (128)	4.5 (113)	13.3 (337)	12.8 (325)	12.9 (327)	1.2 (30)	.9 (22)	7.5 (190)	3.0 (77)	.3 (7)
FR5	5.6 (143)	4.7 (120)	17.0 (434)	16.5 (420)	16.5 (419)	1.4 (36)	.7 (18)	8.4 (214)	3.9 (100)	.3 (7)
FR6	7.7 (195)	6.7 (170)	22.0 (560)	21.6 (549)	22.0 (558)	1.2 (30)	.8 (20)	9.3 (237)	4.2 (106)	.3 (7)

Table 40-278. Dimensions for the Flange Opening, FR4 to FR6

Frame Size	Approximate Dimensions in Inches (mm)							
	W3	W4	W5	H6	H7	H8	H9	Dia. B
FR4	4.8 (123)	4.5 (113)	—	12.4 (315)	12.8 (325)	—	.2 (5)	.3 (7)
FR5	5.3 (135)	4.7 (120)	—	16.2 (410)	16.5 (420)	—	.2 (5)	.3 (7)
FR6	7.3 (185)	6.7 (170)	6.2 (157)	21.2 (539)	21.6 (549)	.3 (7)	.2 (5)	.3 (7)

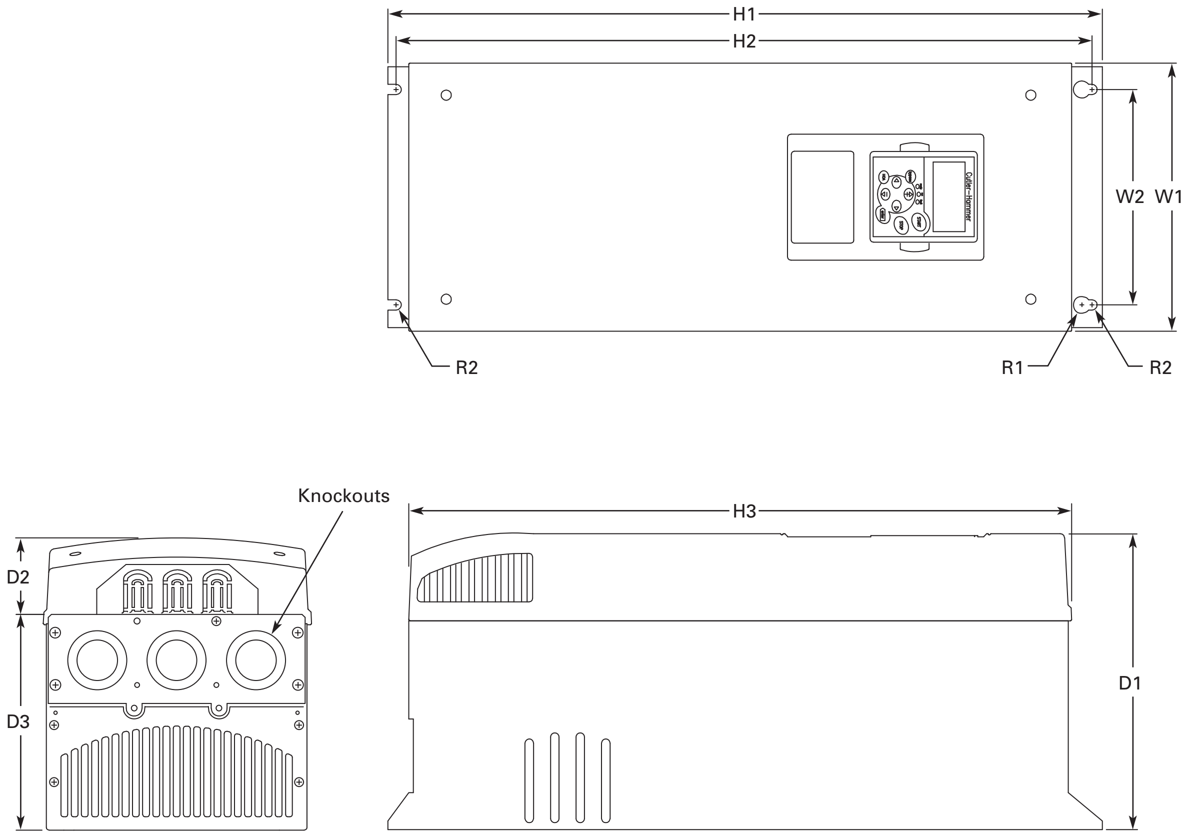


Figure 40-87. HVX9000 Dimensions, NEMA Type 1 and NEMA Type 12, FR7

Table 40-279. HVX9000 Drive Dimensions, FR7

Frame Size	Voltage	hp (I_L)	Approximate Dimensions in Inches (mm)										Weight Lbs. (kg)	Knockouts @ Inches (mm)
			H1	H2	H3	D1	D2	D3	W1	W2	R1 dia.	R2 dia.		N1 (O.D.)
FR7	230V	25 – 40	24.8 (630)	24.2 (614)	23.2 (590)	10.1 (257)	3.0 (77)	7.3 (184)	9.3 (237)	7.5 (190)	.7 (18)	.4 (9)	77.2 (35)	3 @ 1.5 (37)
	480V	50 – 75												
	575V	40 – 50												

40

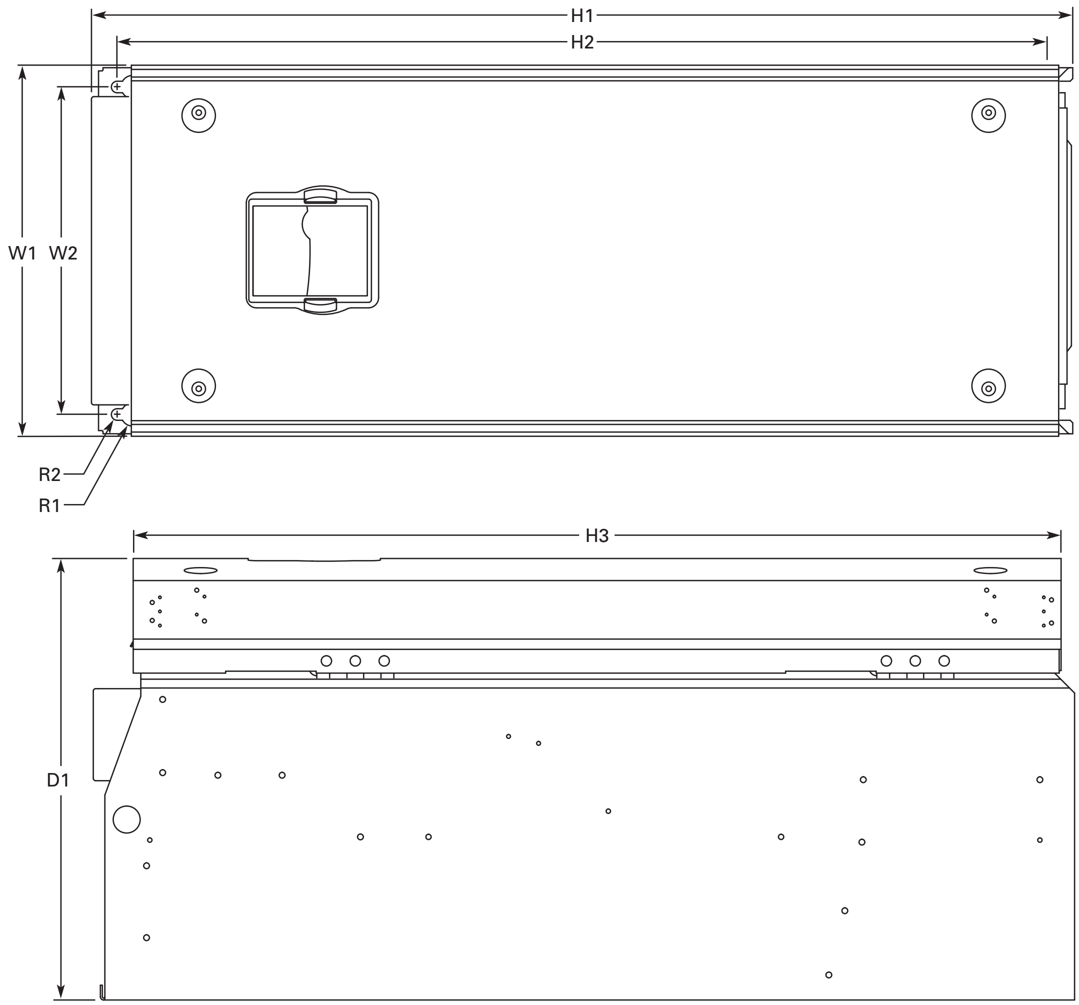


Figure 40-88. HVX9000 Dimensions, NEMA Type 1 and NEMA Type 12, FR8

Table 40-280. HVX9000 Drive Dimensions, FR8

Frame Size	Voltage	hp (I_L)	Approximate Dimensions in Inches (mm)							
			D1	H1	H2	H3	W1	W2	R1 dia.	R2 dia.
FR8	230V	50 – 75	13.5 (344)	30.1 (764)	28.8 (732)	28.4 (721)	11.5 (291)	10 (255)	.7 (18)	.4 (9)
	480V	100 – 150								
	575V	60 – 100								

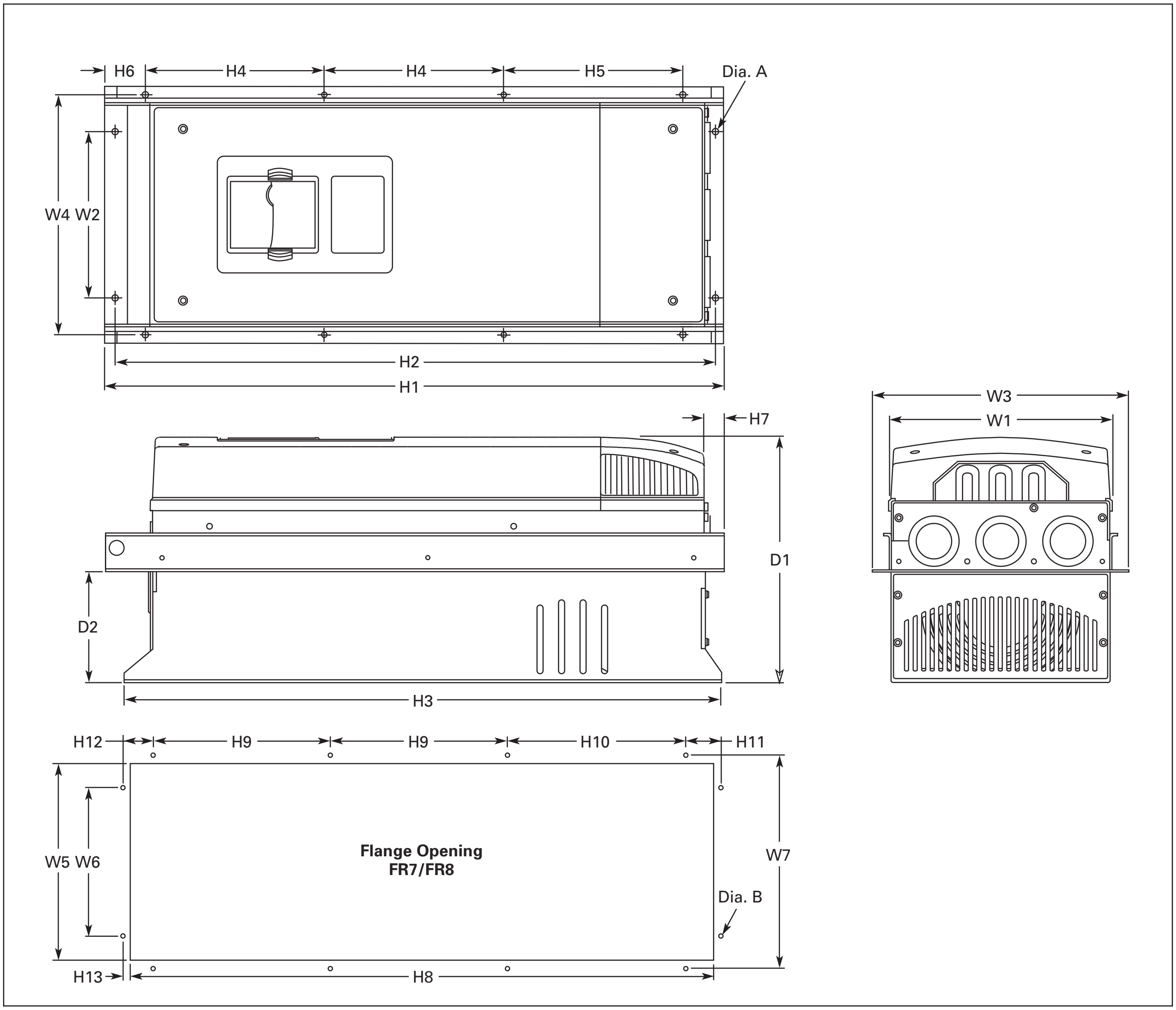


Figure 40-89. HVX9000 Dimensions, NEMA Type 1 and NEMA Type 12, with Flange Kit, FR7 and FR8

Table 40-281. Dimensions for HVX9000, FR7 and FR8 with Flange Kit

Frame Size	Approximate Dimensions in Inches (mm)													
	W1	W2	W3	W4	H1	H2	H3	H4	H5	H6	H7	D1	D2	Dia. A
FR7	9.3 (237)	6.8 (175)	10.6 (270)	10.0 (253)	25.6 (652)	24.8 (632)	24.8 (630)	7.4 (189)	7.4 (189)	.9 (23)	.8 (20)	10.1 (257)	4.6 (117)	.3 (6)
FR8	11.2 (285)	—	14.0 (355)	13.0 (330)	32.8 (832)	—	29.3 (745)	10.2 (258)	10.4 (265)	1.7 (43)	2.2 (57)	13.5 (344)	4.3 (110)	.4 (9)

Table 40-282. Dimensions for the Flange Opening, FR7/FR8

Frame Size	Approximate Dimensions in Inches (mm)									
	W5	W6	W7	H8	H9	H10	H11	H12	H13	Dia. B
FR7	9.2 (233)	6.9 (175)	10.0 (253)	24.4 (619)	7.4 (189)	7.4 (189)	1.4 (35)	1.3 (32)	.3 (7)	.3 (6)
FR8	11.9 (301)	—	13.0 (330)	31.9 (810)	10.2 (258)	10.4 (265)	—	—	—	.4 (9)

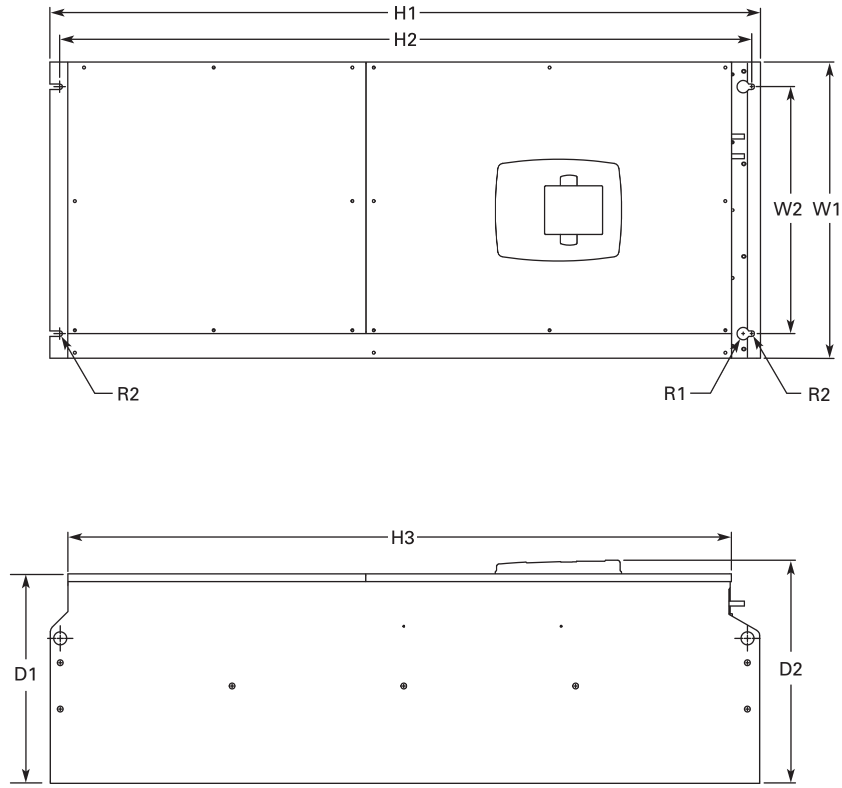


Figure 40-90. HVX9000 Dimensions, NEMA Type 1 and NEMA Type 12, FR9

Table 40-283. HVX9000 Drive Dimensions, FR9

Frame Size	Voltage	hp (I_L)	Approximate Dimensions in Inches (mm)								
			H1	H2	H3	D1	D2	W1	W2	R1 dia.	R2 dia.
FR9	480	200 – 250	45.3 (1150)	44.1 (1120)	42.4 (1076)	13.4 (340)	14.3 (362)	18.9 (480)	15.7 (400)	.8 (20)	.4 (9)
	575	125 – 200									

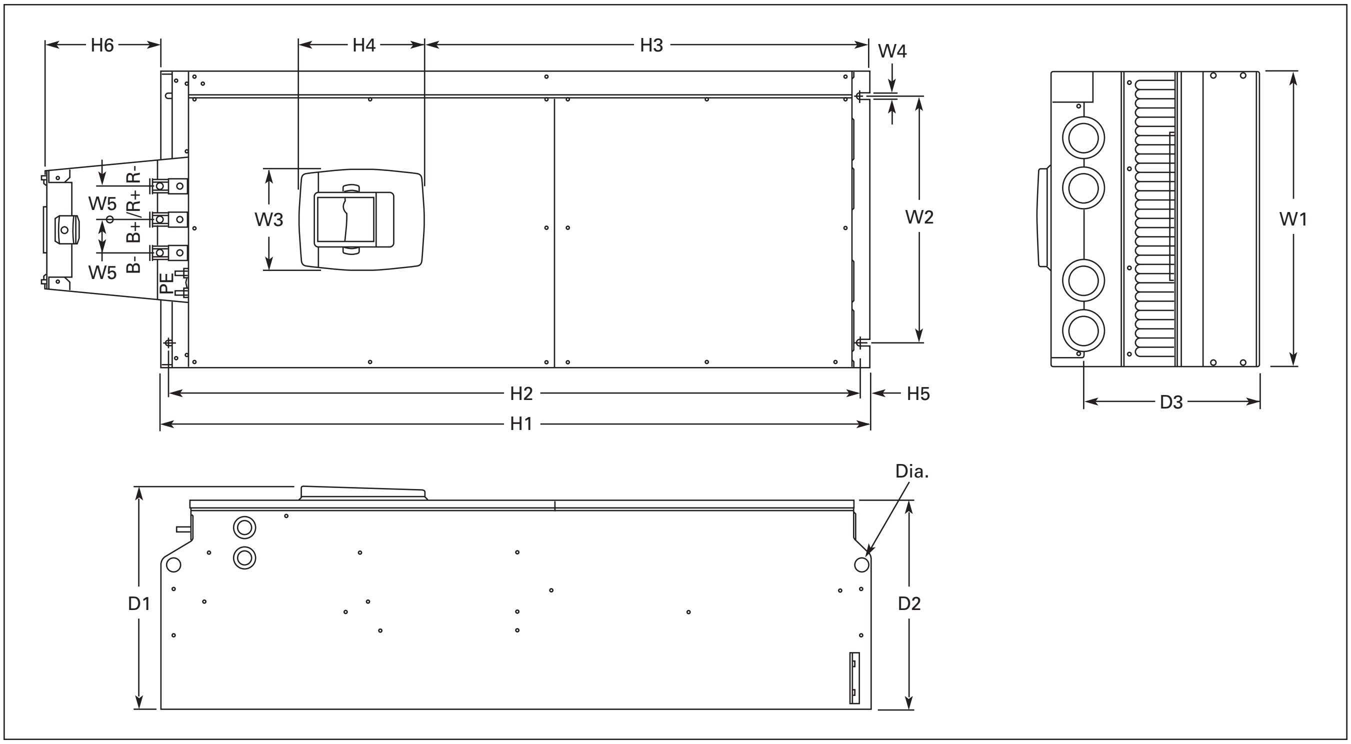


Figure 40-91. HVX9000 Dimensions, NEMA Type 1 and NEMA Type 12 FR9

Table 40-284. Dimensions for HVX9000, FR9

Frame Size	Approximate Dimensions in Inches (mm)													
	W1	W2	W3	W4	W5	H1	H2	H3	H4	H5	H6 ①	D1	D2	D3	Dia.
FR9	18.9 (480)	15.7 (400)	6.5 (165)	.4 (9)	2.1 (54)	45.3 (1150)	44.1 (1120)	28.3 (721)	8.0 (205)	.6 (16)	7.4 (188)	14.2 (361.5)	13.4 (340)	11.2 (285)	.8 (21)

① Brake resistor terminal box (H6) included when brake chopper ordered.

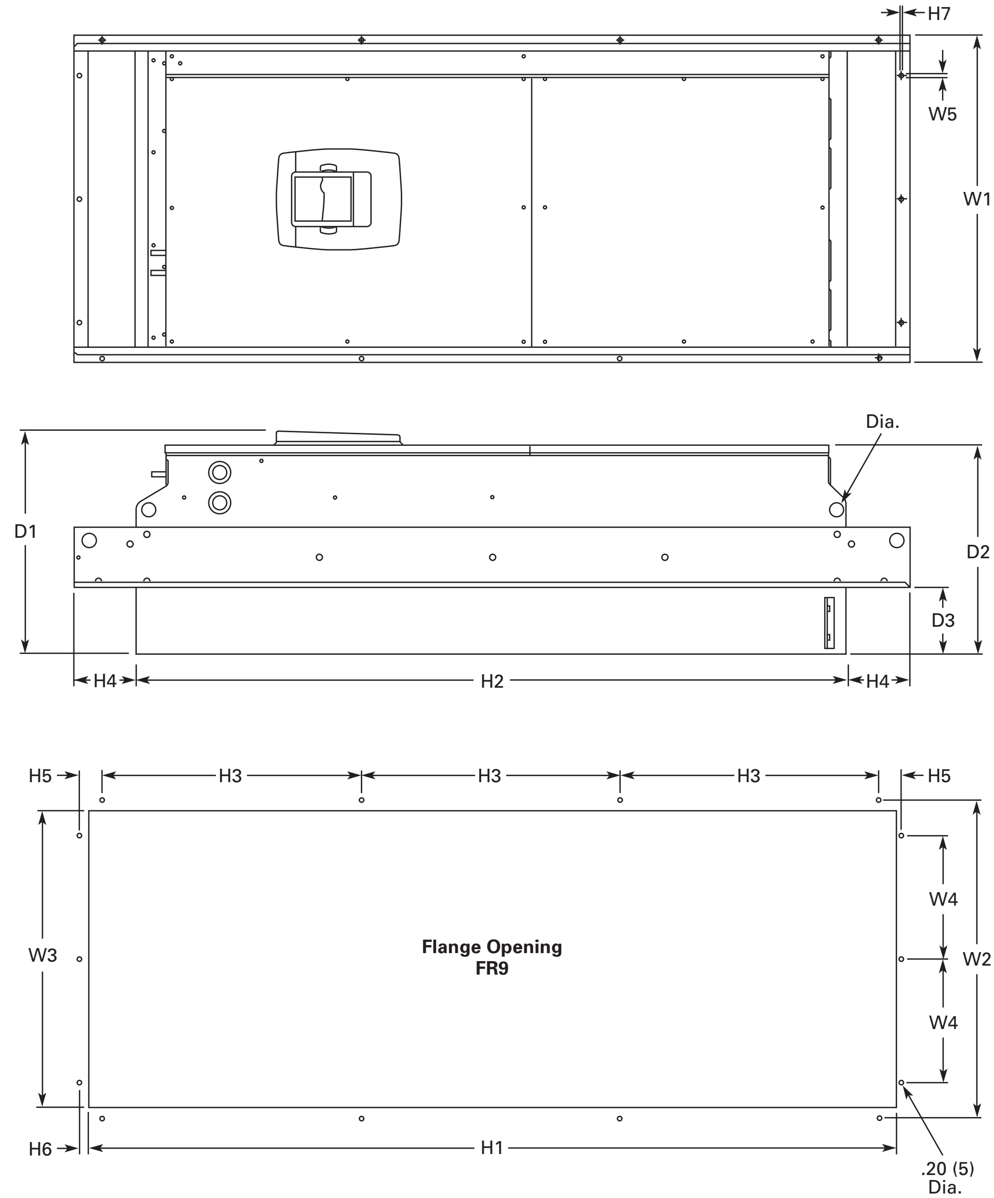


Figure 40-92. HVX9000 Dimensions, NEMA Type 1 and NEMA Type 12 FR9 with Flange Kit

Table 40-285. Dimensions for HVX9000, FR9 with Flange Kit

Frame Size	Approximate Dimensions in Inches (mm)														
	W1	W2	W3	W4	W5	H1	H2	H3	H4	H5	H6	H7	D1	D2	D3	Dia.
FR9	20.9 (530)	20.0 (510)	19.1 (485)	7.9 (200)	.2 (5.5)	51.7 (1312)	45.3 (1150)	16.5 (420)	3.9 (100)	1.4 (35)	.4 (9)	.1 (2)	24.9 (362)	13.4 (340)	4.3 (109)	.8 (21)

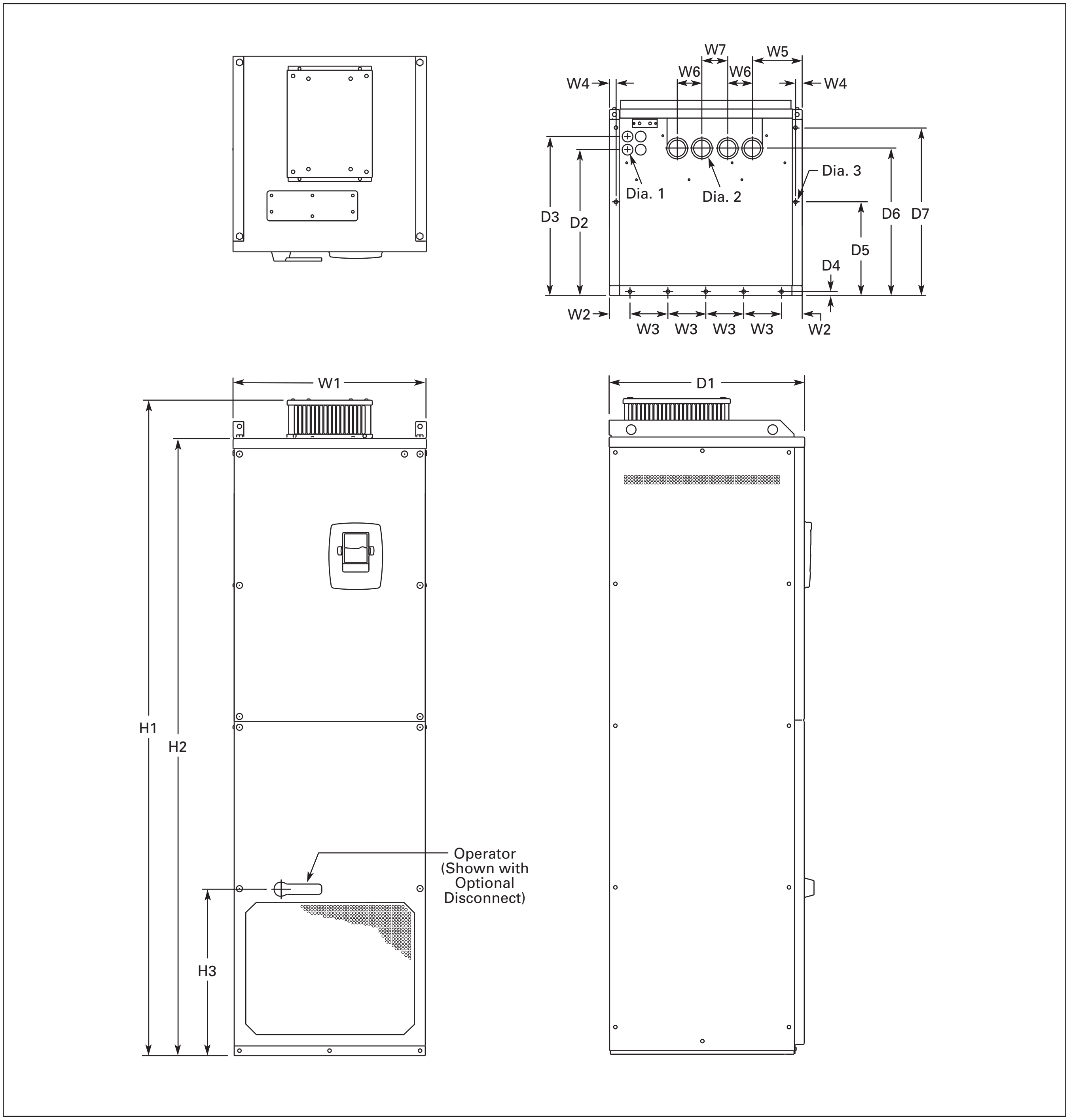


Figure 40-93. 9000X Dimensions, NEMA Type 1 and NEMA Type 12 FR10 Freestanding Drive

Table 40-286. Dimensions for 9000X, FR10 Freestanding Drive

Frame Size	Approximate Dimensions in Inches (mm)																			Weight lbs. (kg)
	W1	W2	W3	W4	W5	W6	W7	H1	H2	H3	D1	D2	D3	D4	D5	D6	D7	Dia. 1	Dia. 2	Dia. 3	
FR10	23.43 (595)	2.46 (62.5)	4.53 (115)	.79 (20)	5.95 (151)	2.95 (75)	3.11 (79)	79.45 (2018)	74.80 (1900)	20.18 (512.5)	23.70 (602)	17.44 (443)	19.02 (483)	.47 (12)	11.22 (285)	17.60 (447)	20.08 (510)	.83 (21)	1.89 (48)	.43 (11)	857 (389)

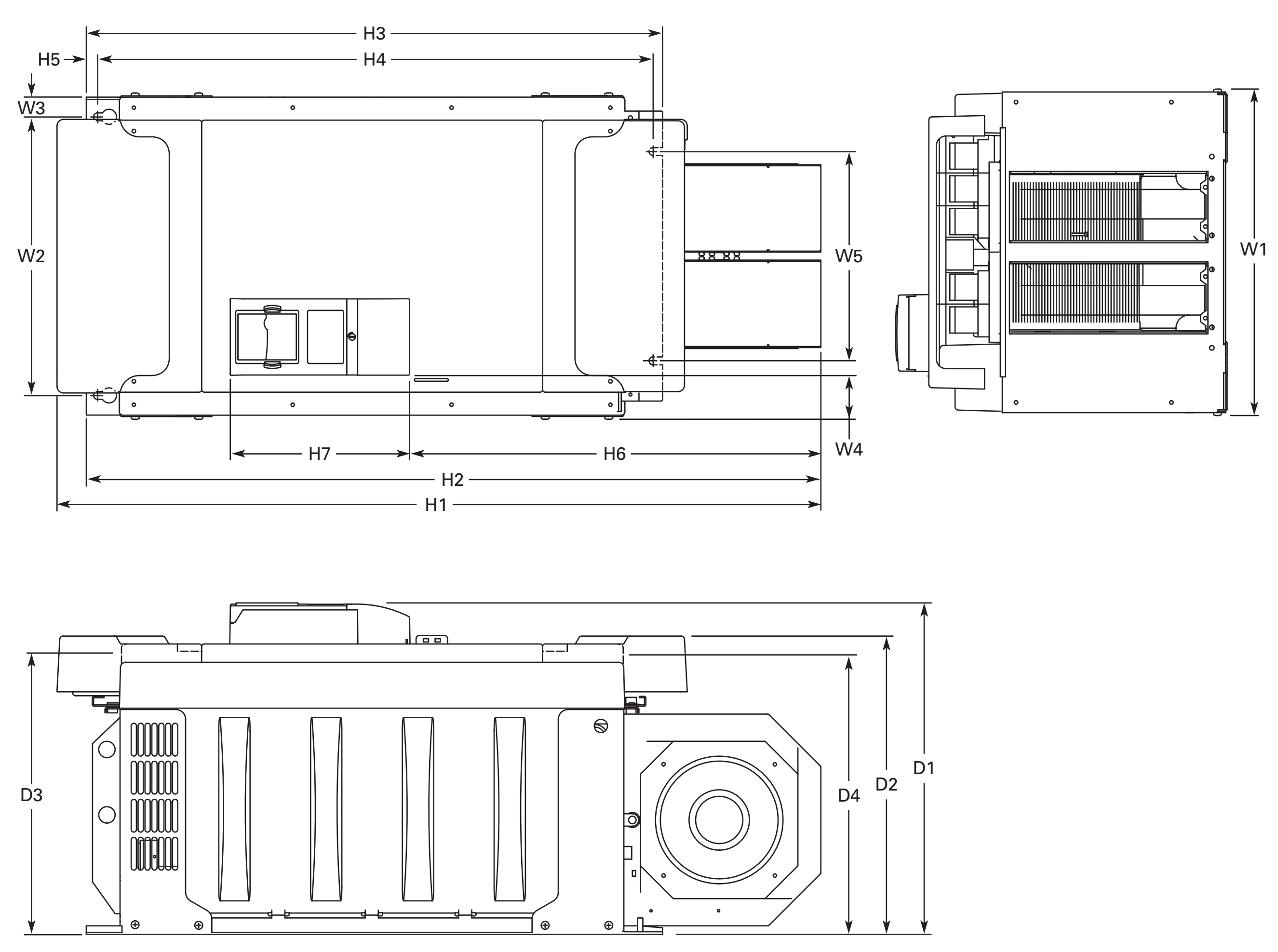
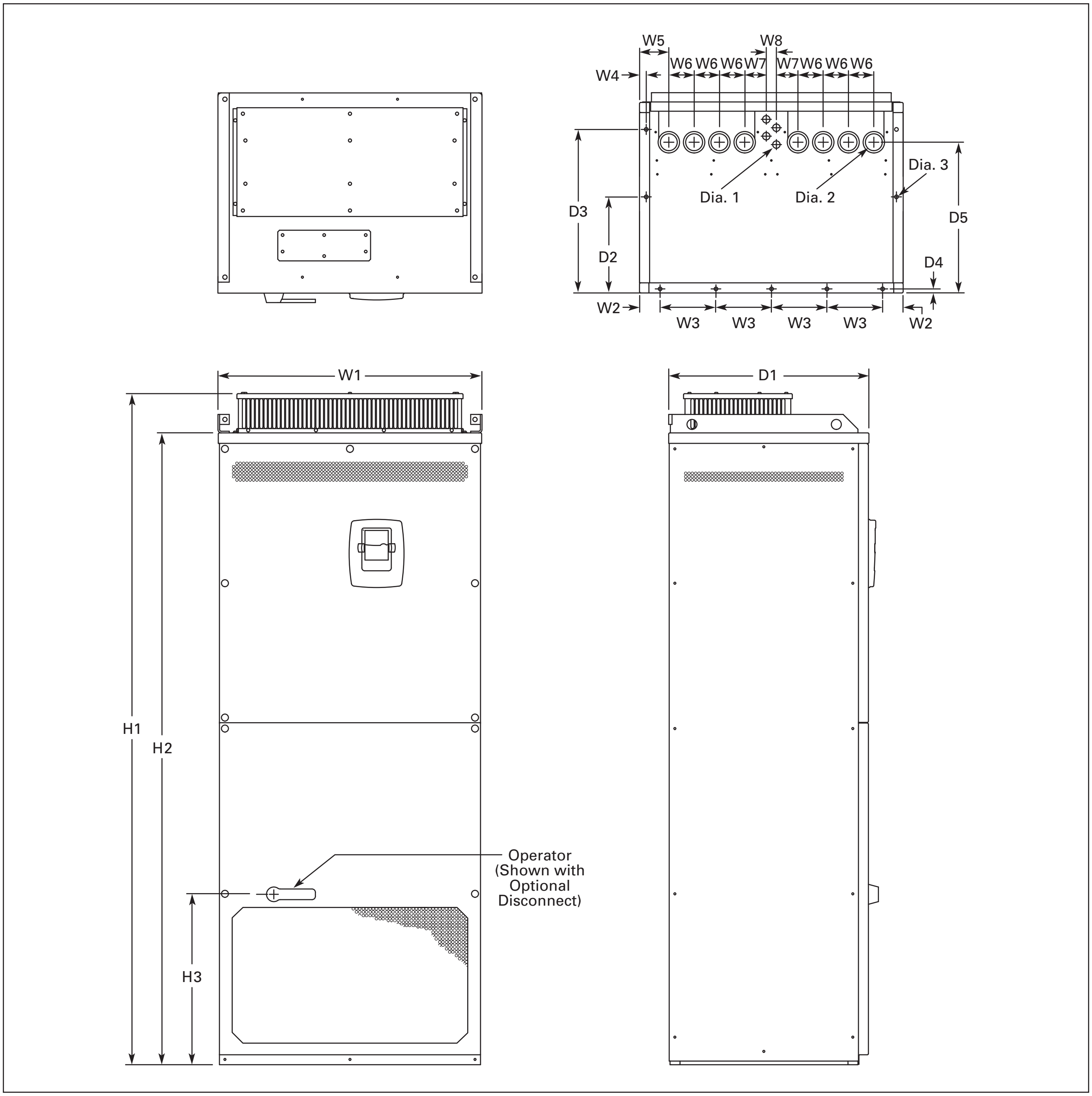


Figure 40-94. HVX9000 Dimensions, FR10 Open Chassis

Table 40-287. Dimensions for HVX9000, FR10 Open Chassis

Frame Size	Voltage	hp (I_L)	Approximate Dimensions in Inches (mm)															
			W1	W2	W3	W4	W5	H1	H2	H3	H4	H5	H6	H7	D1	D2	D3	D4
FR10	480V	300 – 400	19.7 (500)	16.7 (425)	1.2 (30)	2.6 (67)	12.8 (325)	45.9 (1165)	44.1 (1121)	34.6 (879)	33.5 (850)	.7 (17)	24.7 (627)	10.8 (275)	19.9 (506)	17.9 (455)	16.7 (423)	16.6 (421)



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Figure 40-95. HVX9000 Dimensions, NEMA Type 1 FR11 Freestanding Drive

Table 40-288. Dimensions for HVX9000, NEMA Type 1 FR11 Freestanding Drive

Frame Size	Voltage	hp (I_L)	Approximate Dimensions in Inches (mm)																			Weight Lbs. (kg)
			W1	W2	W3	W4	W5	W6	W7	W8	H1	H2	H3	D1	D2	D3	D4	D5	Dia. 1	Dia. 2	Dia. 3	
FR11	480V	500 – 600	31.26 (794)	2.40 (61)	6.50 (165)	.79 (20)	3.43 (87)	2.95 (75)	2.52 (64)	1.18 (30)	79.45 (2018)	74.80 (1900)	20.18 (512.5)	23.70 (602)	11.22 (285)	19.09 (485)	.47 (12)	17.60 (447)	.83 (21)	1.89 (48)	.35 x .43 (9 x 11)	526 (239)

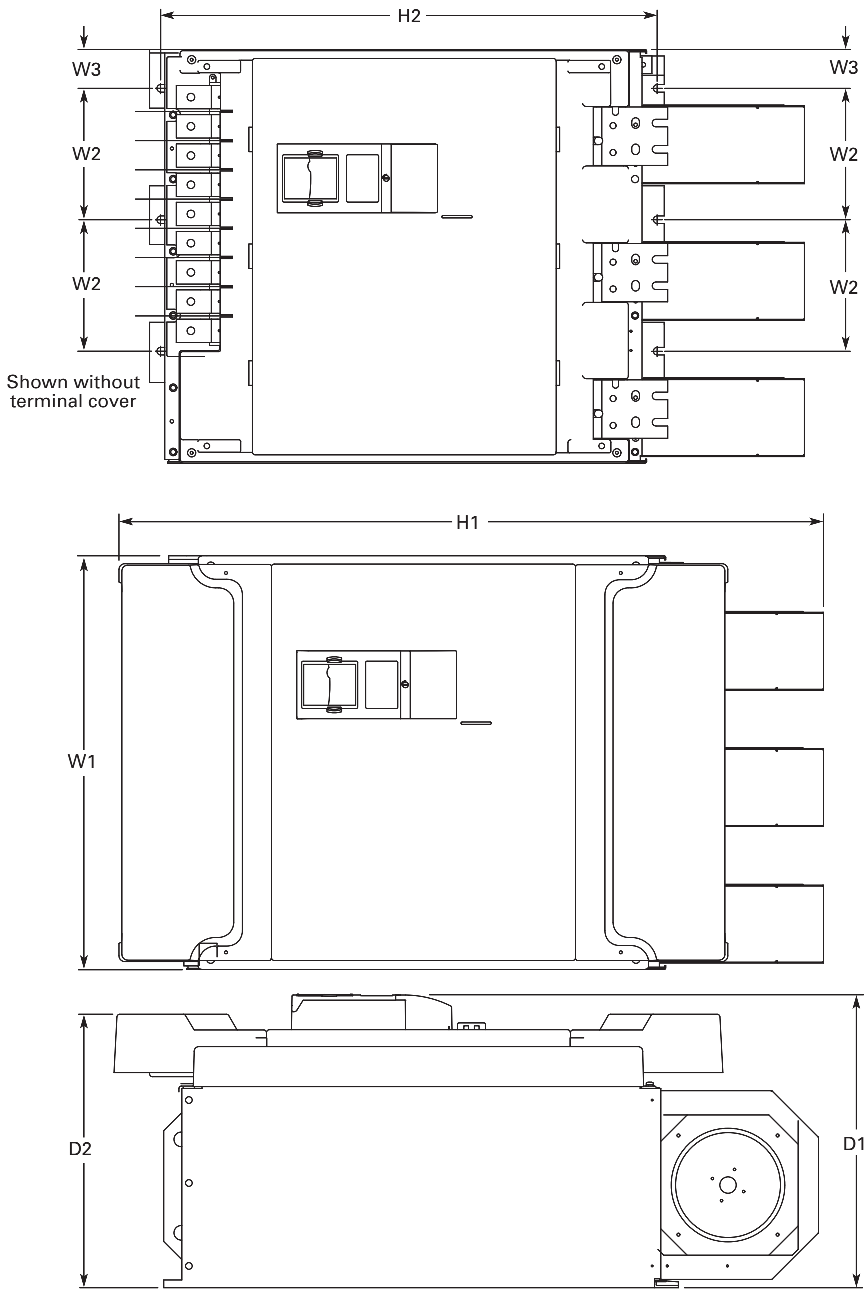


Figure 40-96. HVX9000 Dimensions, FR11 Open Chassis

Table 40-289. Dimensions for HVX9000, FR11 Open Chassis

Frame Size	Voltage	hp (I_L)	Approximate Dimensions in Inches (mm)							Weight Lbs. (kg)
			W1	W2	W3	H1	H2	D1	D2	
FR11	480V	500 – 600	27.9 (709)	8.6 (225)	2.6 (67)	45.5 (1155)	33.5 (850)	19.8 (503)	18.4 (468)	833 (378)

Table 40-290. Choke Types

Catalog Number	Frame Size	Choke Type ①
Voltage Range 380-500V		
HVX 300 4	FR10	CHK0400
HVX 350 4	FR10	CHK0520
HVX 400 4	FR10	CHK0520
HVX 500 4	FR11	2 x CHK0400
HVX 550 4	FR11	2 x CHK0400
HVX 600 4	FR11	2 x CHK0400

① Chokes are provided with all FR10 and FR11 drives.

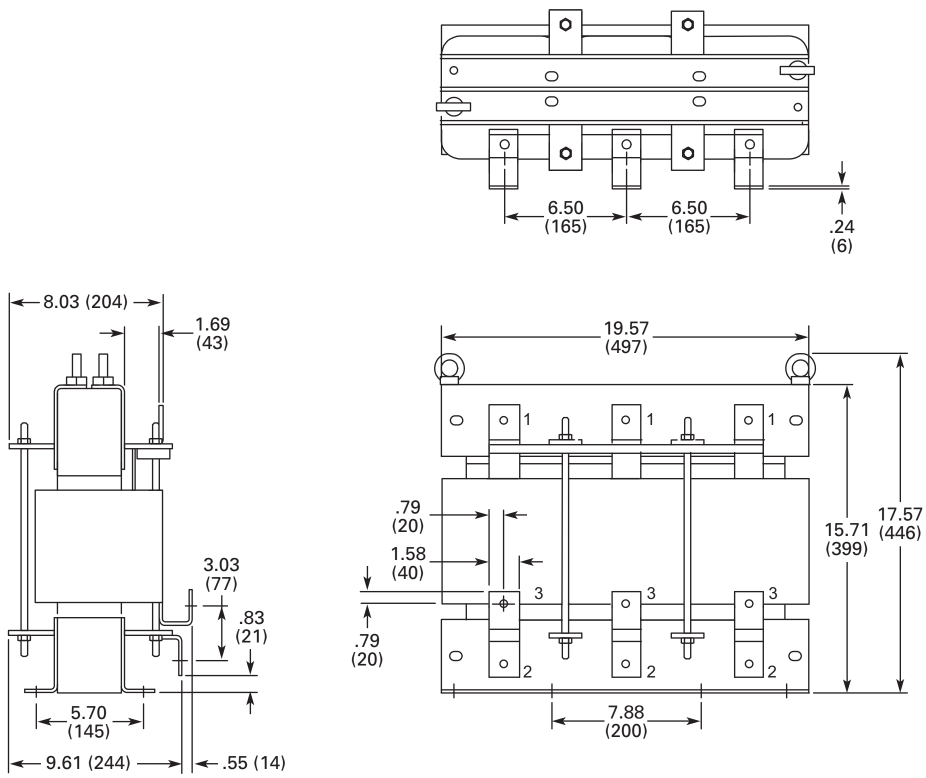


Figure 40-97. Dimensions of AC Choke CHK0520 in Inches (mm)

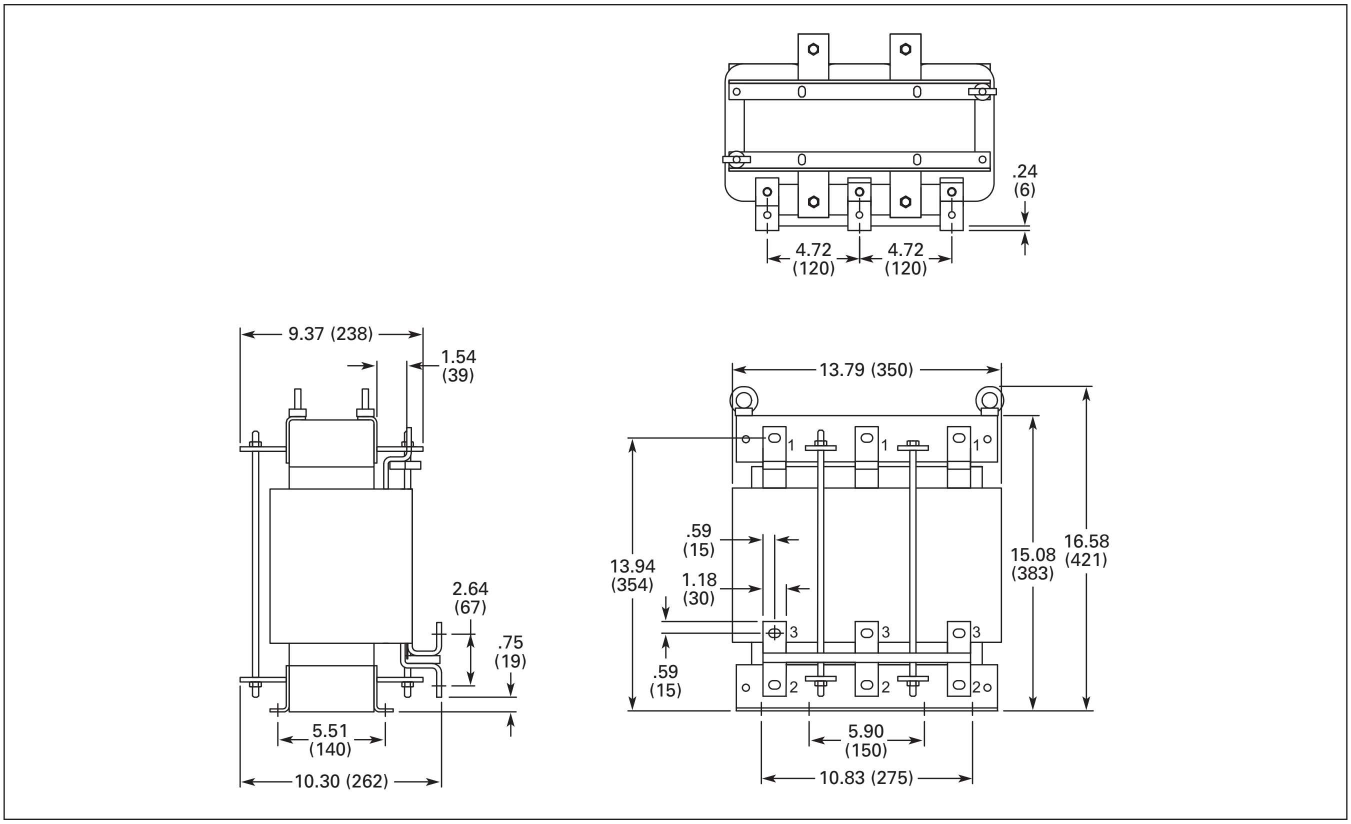


Figure 40-98. Dimensions of AC Choke CHK0400 in Inches (mm)

Replacement Parts

Table 40-291. 9000X Spare Units – HVX9000, 208 – 690V, Frames 4 – 11

Description	Catalog Number	Price U.S. $
Control Unit – Includes the control board, blue base housing, installed HVX9000 software program and blue flip cover. Does not include any OPT boards or keypad. See **Figure 40-84** and **Table 40-266** (**Page 40-172**) for standard and option boards and keypad.	**CSBH0000000000**	

Table 40-292. 9000X Series Replacement Parts — HVX9000 Drives, 208 – 240V

Frame:	4				5			6		7			8			Delivery Code	Catalog Number	Price U.S. $
hp (I_L):	1	1-1/2	2	3	5	7-1/2	10	15	20	25	30	40	50	60	75			
Control Board																		
	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	W	**VB00252**	
Power Boards																		
	1															FB	**VB00308-0004-2**	
		1														FB	**VB00308-0007-2**	
			1													FB	**VB00308-0008-2**	
				1												FB	**VB00310-0011-2**	
					1											FB	**VB00313-0017-2**	
						1										FB	**VB00313-0025-2**	
							1									FB	**VB00313-0031-2**	
								1								FB	**VB00316-0048-2**	
									1							FB	**VB00316-0061-2**	
										1						FB	**VB00319-0075-2**	
											1					FB	**VB00319-0088-2**	
												1				FB	**VB00319-0114-2**	
													1			FB	**VB00322-0140-2**	
														1		FB	**VB00322-0170-2**	
															1	FB	**VB00322-0205-2**	
Electrolytic Capacitors																		
	2	2	2													W	**PP01000**	
				2												W	**PP01001**	
					2	2										W	**PP01002**	
							2									W	**PP01003**	
								2	2							W	**PP01004**	
										2	2	2	4	4		W	**PP01005**	
															4	W	**PP01099**	
Cooling Fans																		
	1	1	1	1												W	**PP01060**	
					1	1	1									W	**PP01061**	
								1	1							W	**PP01062**	
										1	1	1				W	**PP01063**	
													1	1	1	FC	**PP01123** ①	
	1	1	1	1												W	**PP01086**	
					1	1	1	1	1							FC	**PP01088**	
										1	1	1				W	**PP01049**	
													1	2	2	FC	**CP01180**	
													1	1	1	FC	**PP08037**	

① PP00061 capacitor not included in main fan; please order separately.

Discount Symbol........................ **SS-6**

Open Drives

Table 40-292. 9000X Series Replacement Parts — HVX9000 Drives, 208 – 240V (Continued)

Frame:	4				5			6		7			8			Delivery Code	Catalog Number	Price U.S. $
hp (I_L):	1	1-1/2	2	3	5	7-1/2	10	15	20	25	30	40	50	60	75			
IGBT Modules																		
	1	1														W	**CP01304**	
			1													W	**CP01305**	
				1	1											W	**CP01306**	
						1										W	**CP01307**	
							1									W	**CP01308**	
								1								W	**PP01022**	
									1							W	**PP01023**	
										1						W	**PP01024**	
											1					W	**PP01025**	
												1				W	**PP01029**	
													1			W	**PP01026**	
														1	1	W	**PP01027**	
Choppers/Rectifiers																		
								1								W	**CP01367**	
									1							W	**CP01368**	
Diode/Thyristor Modules																		
										3	3	3				W	**PP01035**	
													3	3	3	W	**CP01268**	
Rectifying Boards																		
										1	1	1				W	**VB00242**	
													1	1	1	W	**VB00227**	

Table 40-293. 9000X Series Replacement Parts — FR4 – FR9 HVX9000 Drives, 380 – 500V

Frame:	4					5			6			7			8			9		Delivery Code	Catalog Number	Price U.S. $
hp (I_L):	1-1/2	2	3	5	7-1/2	10	15	20	25	30	40	50	60	75	100	125	150	200	250			
Control Board																						
	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	W	**VB00252**	
Power Boards																						
	1																			FB	**VB00208-0003-5**	
		1																		FB	**VB00208-0004-5**	
			1																	FB	**VB00208-0005-5**	
				1																FB	**VB00208-0007-5**	
					1															FB	**VB00210-0012-5**	
						1														FB	**VB00213-0016-5**	
							1													FB	**VB00213-0022-5**	
								1												FB	**VB00213-0031-5**	
									1											FB	**VB00216-0038-5**	
										1										FB	**VB00216-0045-5**	
											1									FB	**VB00216-0061-5**	
												1								FB	**VB00219-0072-5**	
													1							FB	**VB00219-0087-5**	
														1						FB	**VB00219-0105-5**	
															1					FB	**VB00236-0140-5**	
																1				FB	**VB00236-0168-5**	
																	1			FB	**VB00236-0205-5**	
Electrolytic Capacitors																						
	2	2	2	2																W	**PP01000**	
					2															W	**PP01001**	
						2	2													W	**PP01002**	
								2												W	**PP01003**	
									2	2	2									W	**PP01004**	
												2	2	2	4	4	4	8	8	W	**PP01005**	

Discount Symbol **SS-6**

Table 40-293. 9000X Series Replacement Parts — FR4 – FR9 HVX9000 Drives, 380 – 500V (Continued)

Frame:	4					5			6			7			8			9		Delivery Code	Catalog Number	Price U.S. $
hp (I_L):	1-1/2	2	3	5	7-1/2	10	15	20	25	30	40	50	60	75	100	125	150	200	250			
Cooling Fans																						
	1	1	1	1	1															W	**PP01060**	
						1	1	1												W	**PP01061**	
									1	1	1									W	**PP01062**	
												1	1	1						W	**PP01063**	
															1	1	1			FC	**PP01123** ①	
																		1	1	FC	**PP01080** ②	
	1	1	1	1	1															W	**PP01086**	
						1	1	1												FC	**PP01088**	
									1	1	1	1	1	1						W	**PP01049**	
															1	1	1			FC	**CP01180**	
																		1 ③	2	W	**PP01068**	
																		1	1	FC	**PP09051**	
IGBT Modules																						
	1	1	1																	W	**CP01304**	
				1																W	**CP01305**	
					1	1														W	**CP01306**	
							1													W	**CP01307**	
								1												W	**CP01308**	
									1											W	**PP01020**	
										1										W	**PP01022**	
											1									W	**PP01023**	
												1								W	**PP01024**	
													1							W	**PP01025**	
														1						W	**PP01029**	
															1					W	**PP01026**	
																1	1			W	**PP01027**	
Chopper/Rectifiers																						
									1	1										W	**CP01367**	
											1									W	**CP01368**	
Diode/Thyristor Modules																						
												3	3	3						W	**PP01035**	
															3	3	3			W	**CP01268**	
																		3	3	W	**PP01037**	
Rectifying Boards																						
												1	1	1						W	**VB00242**	
															1	1	1			W	**VB00227**	
																		1	1	W	**VB00459**	
Rectifying Module Sub-assembly																						
																		1	1	W	**FR09810**	
Power Module Sub-assemblies																						
																		1		W	**FR09-150-4-ANS** ④	
																			1	W	**FR09-200-4-ANS** ④	

① PP00061 capacitor not included in main fan; please order separately.
② PP00011 capacitor not included in main fan; please order separately.
③ For FR9 NEMA Type 12 you need two PP01068 internal fans.
④ See **Table 40-297** for details.

Discount Symbol **SS-6**

June 2008

Open Drives

Table 40-294. 9000X Series Replacement Parts — FR10 and FR11 HVX9000 Drives, 380 – 500V

Frame:	10			11			Delivery Code	Catalog Number	Price U.S. $
hp (I_L):	300	350	400	500	550	600			
Control Board									
	1	1	1	1	1	1	W	**VB00561** ①	
Shunt Boards									
	6						FC	**VB00537**	
		6					FC	**VB00497**	
			6				FC	**VB00498**	
				9			FC	**VB00538**	
					9		FC	**VB00513**	
						9	FC	**VB00514**	
Driver Boards									
				3	3	3	FC	**VB00489**	
	1	1	1				FC	**VB00487**	
Driver Adapter Board									
	1	1	1				FC	**VB00330**	
ASIC Board									
	1	1	1	1	1	1	FC	**VB00451**	
Feedback Interface Board									
							FC	**VB00448**	
Star Coupler Board									
							FC	**VB00336**	
Power Modules									
	1	1	1	2	2	2	FC	**FR10820** ②	
	2	2	2				FC	**FR10828**	
	1						FC	**FR10-250-4-ANS** ③	
		1					FC	**FR10-300-4-ANS** ③	
			1				FC	**FR10-350-4-ANS** ③	
				3			FC	**FR11-400-4-ANS** ③	
					3		FC	**FR11-500-4-ANS** ③	
						3	FC	**FR11-550-4-ANS** ③	
Electrolytic Capacitors									
	2	2	2	3	3	3	FC	**PP00060**	
	12	12	12	18	18	18	FC	**PP01005**	
Fuses									
	1	1	1	1	1	1	FC	**PP01094**	
	2	2	2	2	2	2	FC	**PP01095**	
Cooling Fans and Isolation Transformers									
	2	2	2	3	3	3	FC	**VB00299**	
	2	2	2	3	3	3	FC	**PP01080** ④	
	2	2	2				FC	**PP01068**	
	1	1	1	1	1	1	FC	**PP01096**	
	1	1	1				FC	**FR10844**	
	1	1	1	3	3	3	FC	**FR10845**	
	1	1	1				FC	**FR10846**	
	1	1	1	3	3	3	FC	**FR10847**	
Rectifying Board									
	1	1	1	2	2	2	FC	**VB00459**	

① FR10 and larger drives only.
② Rectifying board not included.
③ See **Table 40-297** for details.
④ PP00060 capacitor not included in main fan; please order separately.

Discount Symbol **SS-6**

Table 40-295. 9000X Series Replacement Parts — FR6 – FR9 HVX9000 Drives, 525 – 690V

Frame:	6								7		8			9			Delivery Code	Catalog Number	Price U.S. $
hp (I_L):	3	5	7-1/2	10	15	20	25	30	40	50	60	75	100	125	150	200			
Control Board																			
	1	1	1	1	1	1	1	1	1	1					1	1	W	VB00252	
Driver Board																			
	1																FB	VB00404-0004-6	
																	FB	VB00404-0005-6	
		1															FB	VB00404-0007-6	
			1														FB	VB00404-0010-6	
				1													FB	VB00404-0013-6	
					1												FB	VB00404-0018-6	
						1											FB	VB00404-0022-6	
							1										FB	VB00404-0027-6	
								1									FB	VB00404-0034-6	
Power Boards																			
									1								FB	VB00419-0041-6	
										1							FB	VB00419-0052-6	
											1						FB	VB00422-0062-6	
												1					FB	VB00422-0080-6	
													1				FB	VB00422-0100-6	
Power Modules																			
														1			FC	FR09-100-5-ANS ①	
															1		FC	FR09-125-5-ANS ①	
																1	FC	FR09-175-5-ANS ①	
Electrolytic Capacitors																			
	2	2	2	2	2	2	2	2									FC	PP01093	
									2	2	4	4		8	8	8	FC	PP01041	
													4				FC	PP01040	
Fuses																			
											1	1	1	1	1	1	W	PP01094	
											2	2	2	2	2	2	W	PP01095	
Cooling Fans																			
	1	1	1	1													W	PP01061	
					1	1	1	1									W	PP01062	
									1	1							W	PP01063	
											1	1	1				FC	PP01123	
	1	1	1	1	1	1	1	1	1	1							W	PP01049	
											1	1	1				FC	CP01180	
														1	1	1 ②	W	PP01068	
														1	1	1	FC	PP01080	
Fan Power Supply																			
															1	1	FC	VB00299	
IGBT Modules																			
	3	3	3	3	3	3	3	3									FC	PP01091	
									1	1							FC	PP01089	
											1	1	1				FC	PP01127	
IGBT/Diode (Brake)																			
	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	FC	PP01040	
Diode Module																			
	1	1	1	1	1	1	1	1									FC	PP01092	
Diode/Thyristor Modules																			
									3	3							FC	PP01071	
														3	3	3	FC	PP01072	
Rectifying Boards																			
									1	1							FC	VB00442	
														1	1	1	FC	VB00460	
Rectifying Module Sub-assemblies																			
															1	1	W	FR09810	
															1	1	FC	FR09811	

① See **Table 40-297** for details.
② For NEMA Type 12, two PP01068 internal fans are needed.

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Discount Symbol **SS-6**

Open Drives

Table 40-296. 9000X Series Replacement Parts — FR10 and FR11 HVX9000 Drives, 525 – 690V

Frame:	10			11			Delivery Code	Catalog Number	Price U.S. $
hp (I_L):	250	300	400	450	500	550			
Component Boards									
	1	1	1	1	1	1	W	**VB00561** ①	
	1	1	1	1	1	1	FC	**VB00451**	
	6						FC	**VB00545**	
		6					FC	**VB00510**	
			6				FC	**VB00511**	
	1	1	1				FC	**VB00330**	
	1	1	1				FC	**VB00487**	
				3	3	3	FC	**VB00489**	
				9			FC	**VB00546**	
					9		FC	**VB00547**	
						9	FC	**VB00512**	
							FC	**VB00448**	
							FC	**VB00336**	
Power Modules									
	1	1	1	2	2	2	FC	**FR10821** ②	
	2	2	2				FC	**FR10829**	
	1						FC	**FR10-200-5-ANS** ③	
		1					FC	**FR10-250-5-ANS** ③	
			1				FC	**FR10-300-5-ANS** ③	
				3			FC	**FR11-400-5-ANS** ③	
					3		FC	**FR11-450-5-ANS** ③	
						3	FC	**FR11-500-5-ANS** ③	
Electrolytic Capacitors									
	2	2	2	3	3	3	FC	**PP00060**	
	12	12	12	18	18	18	FC	**PP01099**	
Fuses									
	1	1	1	1	1	1	FC	**PP01094**	
	2	2	2	2	2	2	FC	**PP01095**	
Cooling Fans and Isolation Transformers									
	2	2	2	3	3	3	FC	**VB00299**	
	2	2	2	3	3	3	FC	**PP01080** ④	
	2	2	2				FC	**PP01068**	
	1	1	1	1	1	1	FC	**PP01096**	
	1	1	1				FC	**FR10844**	
	1	1	1	3	3	3	FC	**FR10845**	
	1	1	1				FC	**FR10846**	
	1	1	1	3	3	3	FC	**FR10847**	
Fan Power Supply									
							FC	**VB00299**	
Rectifying Boards									
	1	1	1	2	2	2	FC	**VB00460**	

① FR10 and larger drives only.
② Rectifying board not included.
③ See **Table 40-297** for details.
④ PP00060 capacitor not included in main fan; please order separately.

Table 40-297. Power Module Catalog Number Matrix

FR10 – 000 – 4 – A N S

Frame Code

Horsepower
Example: **150** = 150 hp

Voltage
4 = 380 – 500V **5** = 525 – 690V

Cooling Type
A = Air

Brake Option
N = No Brake Chopper **B** = Brake Chopper

Varnishing
S = Standard **V** = Varnished

Discount Symbol **SS-6**

Contents



NEMA Type 1



NEMA Type 12



NEMA Type 3R

Product Description

The Cutler-Hammer® IntelliDisconnect Drive from Eaton's electrical business combines a premier quality drive with a circuit breaker disconnect integrated into the design. Eaton's IntelliPass Drive continues the Cutler-Hammer tradition of providing a premier intelligent drive integrated with a reliable bypass configuration, by taking advantage of the Cutler-Hammer Intelligent Technologies (***IT.***), enclosed control and circuit breaker expertise.

The IntelliPass bypass is a two- or three-contactor design utilizing the 24V DC ***IT.*** series of contactors and power supplies. The ***IT.*** features, function and form allow the drive and bypass to become an integrated design, enabling Eaton to manufacture the world's smallest drive and bypass package. The IntelliPass comes standard with a Cutler-Hammer circuit breaker integrated into the drive and bypass design.

Features and Benefits

IntelliPass/IntelliDisconnect

- Circuit breaker provides flexible drive isolation configurations to meet customers' needs
- Reliable drive with over 500,000 hours MTBF
- Weighs up to 70% less than other designs which simplifies and speeds up the installation process, lowering contractors' costs
- Serial communication interface enables control of the motor operated by the drive or bypass
- Plenum rated
- Designed and tested to UL 508C specifications
- Standard 3% line reactors for enhanced transient and harmonic distortion protection
- EMI/RFI Filters standard on all drives
- Top and bottom conduit entry for installation ease
- Standard drive current with standard rating of 100 kAIC
- Upgradeable software extends product life
- Pass-through I/O capability
- Additional I/O and communication cards provide plug and play functionality
- Copy/Paste keypad function allows transfer of parameter settings from one drive to the next
- Optional Fusing —
  - Fuse rating 200 kAIC
- Keypad can display up to three monitored parameters simultaneously
- Hand-held Power Supply option allows programming/monitoring of control module without applying power to the drive
- NEMA Type 1, 12 or 3R
- Standard NEMA Type 12 keypad on all drives
- Simplified operating menu allows for typical programming changes
- Accommodates a wide selection of expander boards and adapter boards
- Control logic can be powered from an external auxiliary control panel
- Standard I/O boards include 6 DI, 2AI, 1 DO, 1 AO, 2 form C RO and a bypass control board installed in slots A, B and C

IntelliPass

- Fully rated, mechanically and electrically interlocked contacts
- Solid-state motor overload relay provides motor protection while in bypass
- HAND/OFF/AUTO and DRIVE/BYPASS selector on keypad simplifies control
- Two power sources for control ensure redundancy and provide additional ride-through capability
- Self-healing power supplies
- Bypass circuit current interrupting rating up to 65 kAIC

Technical Data and Specifications

Table 40-298. HVX9000 Specifications

Description	Specification
Power Connections	
Input Voltage (V_{in})	+10% / -15%
Input Frequency (f_{in})	50/60 Hz (variation up to 45 – 66 Hz)
Connection to Power	Once per minute or less (typical operation)
Short Circuit Withstand Rating	65 k AIC ①
Motor Connections	
Output Voltage	0 to V_{in}
Continuous Output Current	Ambient temperature max. +104°F(+40°C)
Overload Current	110% (1 min./10 min.)
Output Frequency	0 to 320 Hz
Frequency Resolution	.01 Hz
Control Characteristics	
Control Method	Frequency Control (V/f) Open Loop Sensorless Vector Control
Switching Frequency	Adjustable Parameter 1 – 40 hp: 1 to 16 kHz; default 10 kHz 50 – 75 hp: 1 to 10 kHz; default 3.6 kHz
Frequency Reference	Analog Input: Resolution .1% (10-bit), accuracy ± 1% Panel Reference: Resolution .01 Hz
Field Weakening Point	30 to 320 Hz
Acceleration Time	0 to 3000 sec.
Deceleration Time	0 to 3000 sec.
Braking Torque	DC brake: 30% x T_n (without brake option)
Ambient Conditions	
Ambient Operating Temperature	14°F (-10°C), no frost to 104°F (+40°C)
Storage Temperature	-40°F (-40°C) to 158°F (70°C)
Relative Humidity	0 to 95% RH, noncondensing, non-corrosive, no dripping water
Air Quality	Chemical vapors: IEC 721-3-3, unit in operation, class 3C2; Mechanical particles: IEC 721-3-3, unit in operation, class 3S2
Altitude	100% load capacity (no derating) up to 3280 ft. (1000m); 1% derating for each 328 ft. (100m) above 3280 ft. (1000m); max. 9842 ft. (3000m)
Enclosure Class	NEMA Type 1/IP21; NEMA Type 12, NEMA Type 3R
Standards	
EMC (at default settings)	Immunity: Fulfills all EMC immunity requirements; Emissions: EN 61800-3, LEVEL H
Safety	UL 508C
Product	IEC 61800-2

① 65kAIC on Type 1 units operating at a line input voltage of 480V or less.

Description	Specification
Control Connections	
Analog Input Voltage	0 to 10V, R = 200Ω differential (-10 to 10V joystick control) Resolution .1%; accuracy ±1%
Analog Input Current	0(4) to 20 mA; R_i - 250Ω differential
Digital Inputs (6)	Positive or negative logic; 18 to 24V DC
Auxiliary Voltage	+24V ±15%, max. 250 mA
Output Reference Voltage	+10V +3%, max. load 10 mA
Analog Output	0(4) to 20 mA; R_L max. 500Ω; Resolution 10 bit; Accuracy ±2%
Digital Outputs	Open collector output, 50 mA/48V
Relay Outputs	2 programmable Form C relay outputs Switching capacity: 24V DC / 8A, 250V AC / 8A, 125V DC / .4A
Protections	
Overcurrent Protection	Trip limit 4.0 x I_H instantaneously
Overvoltage Protection	Yes
Undervoltage Protection	Yes
Earth Fault Protection	In case of earth fault in motor or motor cable, only the frequency converter is protected
Input Phase Supervision	Trips if any of the input phases are missing
Motor Phase Supervision	Trips if any of the output phases are missing
Overtemperature Protection	Yes
Motor Overload Protection	Yes
Motor Stall Protection	Yes
Motor Underload Protection	Yes
Short Circuit Protection	Yes (Of the +24V and +10V Reference Voltages)
General	
Line Voltage	208/230/480V
Drive Efficiency	>95%
Power Factor (Displacement)	.96
Ratings	UL Listed, File No. E134360
Warranty	Standard Terms

Catalog Number Selection

Table 40-299. HVX9000 IntelliPass/IntelliDisconnect Drive Catalog Numbering System

HVX 010 1 4 B 1 _ _ _ _ _ _ _

Product Family

- **HVX** = HVAC Drive Family

Horsepower Rating (I_L)

001 = 1	**030** = 30
002 = 2	**040** = 40
003 = 3	**050** = 50
005 = 5	**060** = 60
007 = 7-1/2	**075** = 75
010 = 10	**100** = 100
015 = 15	**125** = 125
020 = 20	**150** = 150
025 = 25	

Enclosure Rating

- **1** = NEMA Type 1
- **2** = NEMA Type 12
- **3** = NEMA Type 3R

Voltage Rating

1 = 208V	**4** = 480V
2 = 230V	

Brake Chopper Options ①

- **B** = With Brake Chopper
- **N** = No Brake Chopper

Enclosure Style

- **1** = IntelliPass
- **2** = IntelliDisconnect

Options

Options appear in alphabetical order; if no options are included, these spaces will be blank.

Power Options

- **P3** = Fused Drive Isolation ④
- **P6** = 3rd Contactor Drive Isolation ④⑥
- **K9** = (2) Factory Installed Auxiliary Contacts ⑥
- **PE** = Output Contactor ⑦

Enclosure Options

- **SA** = Space Heater ⑤
- **S5** = Floor Stand 22"

Extended I/O Card Options ②

- **B4** = OPTB4: (1) AI, (2) AO
- **B5** = OPTB5: (3) RO

Communication Cards ②③

- **C2** = OPTC2: Modbus
- **C4** = OPTC4: Lonworks
- **CA** = OPTC2: Johnson Controls N2
- **CB** = Siemens Apogee FLN
- **CJ** = BACnet

① 480V Drives, 1 – 40 hp are only available with Brake Chopper Option **B**.
480V Drives, 50 – 150 hp are only available with Brake Chopper Option **N**.
208/230V Drives, 1 – 20 hp are only available with Brake Chopper Option **B**.
208/230V Drives, 25 – 75 hp are only available with Brake Chopper Option **N**.
② Two slots (D, E) available for expansion cards.
③ Only one communication card can be installed at a time.
④ Fused Drive Isolation (**P3**) and 3rd Contactor Drive Isolation (**P6**) cannot be installed together in NEMA Type 1 Design.
⑤ Space Heater (**SA**) option only applicable in NEMA Type 12/3R enclosures.
⑥ IntelliPass Only.
⑦ IntelliDisconnect Only.

Product Selection

Table 40-300. HVX9000 IntelliPass Base Unit Pricing

Frame Size	Delivery Code	Voltage	hp (I_L)	Current (NEC)	NEMA Type 1		NEMA Type 12		NEMA Type 3R	
					Catalog Number	Price U.S. $	Catalog Number	Price U.S. $	Catalog Number	Price U.S. $
FR4	FB10	208V AC	1	4.6	**HVX00111B1**		**HVX00121B1**		**HVX00131B1**	
			2	7.5	**HVX00211B1**		**HVX00221B1**		**HVX00231B1**	
			3	10.6	**HVX00311B1**		**HVX00321B1**		**HVX00331B1**	
		230V AC	1	4.2	**HVX00112B1**		**HVX00122B1**		**HVX00132B1**	
			2	6.8	**HVX00212B1**		**HVX00222B1**		**HVX00232B1**	
			3	9.6	**HVX00312B1**		**HVX00322B1**		**HVX00332B1**	
		480V AC	1	3	**HVX00114B1**		**HVX00124B1**		**HVX00134B1**	
			2	3.4	**HVX00214B1**		**HVX00224B1**		**HVX00234B1**	
			3	4.8	**HVX00314B1**		**HVX00324B1**		**HVX00334B1**	
			5	7.6	**HVX00514B1**		**HVX00524B1**		**HVX00534B1**	
			7-1/2	11	**HVX00714B1**		**HVX00724B1**		**HVX00734B1**	
FR5	FB10	208V AC	5	16.7	**HVX00511B1**		**HVX00521B1**		**HVX00531B1**	
			7-1/2	24.2	**HVX00711B1**		**HVX00721B1**		**HVX00731B1**	
			10	30.8	**HVX01011B1**		**HVX01021B1**		**HVX01031B1**	
		230V AC	5	15.2	**HVX00512B1**		**HVX00522B1**		**HVX00532B1**	
			7-1/2	22	**HVX00712B1**		**HVX00722B1**		**HVX00732B1**	
			10	28	**HVX01012B1**		**HVX01022B1**		**HVX01032B1**	
		480V AC	10	14	**HVX01014B1**		**HVX01024B1**		**HVX01034B1**	
			15	21	**HVX01514B1**		**HVX01524B1**		**HVX01534B1**	
			20	27	**HVX02014B1**		**HVX02024B1**		**HVX02034B1**	
FR6	FB10	208V AC	15	46.2	**HVX01511B1**		**HVX01521B1**		**HVX01531B1**	
			20	59.4	**HVX02011B1**		**HVX02021B1**		**HVX02031B1**	
		230V AC	15	42	**HVX01512B1**		**HVX01522B1**		**HVX01532B1**	
			20	54	**HVX02012B1**		**HVX02022B1**		**HVX02032B1**	
		480V AC	25	34	**HVX02514B1**		**HVX02524B1**		**HVX02534B1**	
			30	40	**HVX03014B1**		**HVX03024B1**		**HVX03034B1**	
			40	52	**HVX04014B1**		**HVX04024B1**		**HVX04034B1**	
FR7	FB10	208V AC	25	74.8	**HVX02511N1**		**HVX02521N1**		**HVX02531N1**	
			30	88	**HVX03011N1**		**HVX03021N1**		**HVX03031N1**	
		230V AC	25	68	**HVX02512N1**		**HVX02522N1**		**HVX02532N1**	
			30	80	**HVX03012N1**		**HVX03022N1**		**HVX03032N1**	
		480V AC	50	65	**HVX05014N1**		**HVX05024N1**		**HVX05034N1**	
			60	77	**HVX06014N1**		**HVX06024N1**		**HVX06034N1**	
			75	96	**HVX07514N1**		**HVX07524N1**		**HVX07534N1**	
FR8	FB10	208V AC	40	114	—		**HVX04021N1** ①		**HVX04031N1** ①	
			50	140	—		**HVX05021N1**		**HVX05031N1**	
			60	170	—		**HVX06021N1**		**HVX06031N1**	
		230V AC	40	104	—		**HVX04022N1** ①		**HVX04032N1** ①	
			50	130	—		**HVX05022N1**		**HVX05032N1**	
			60	154	—		**HVX06022N1**		**HVX06032N1**	
			75	192	—		**HVX07522N1**		**HVX07532N1**	
		480V AC	100	124	—		**HVX10024N1**		**HVX10034N1**	
			125	156	—		**HVX12524N1**		**HVX12534N1**	
			150	180	—		**HVX15024N1**		**HVX15034N1**	

① 40 hp 208V and 230V supplied as a FR7 drive, but in a C-Box.

Discount Symbol **SS-6**

Table 40-301. HVX9000 IntelliDisconnect Base Unit Pricing

Frame Size	Delivery Code	Voltage	hp (I_L)	Current	NEMA Type 1		NEMA Type 12		NEMA Type 3R	
					Catalog Number	Price U.S. $	Catalog Number	Price U.S. $	Catalog Number	Price U.S. $
FR4	FB10	208V AC	1 2 3	4.8 7.8 11	**HVX00111B2 HVX00211B2 HVX00311B2**		**HVX00121B2 HVX00221B2 HVX00321B2**		**HVX00131B2 HVX00231B2 HVX00331B2**	
		230V AC	1 2 3	4.8 7.8 11	**HVX00112B2 HVX00212B2 HVX00312B2**		**HVX00122B2 HVX00222B2 HVX00322B2**		**HVX00132B2 HVX00232B2 HVX00332B2**	
		480V AC	1 2 3 5 7-1/2	3.3 4.3 5.6 7.6 12	**HVX00114B2 HVX00214B2 HVX00314B2 HVX00514B2 HVX00714B2**		**HVX00124B2 HVX00224B2 HVX00324B2 HVX00524B2 HVX00724B2**		**HVX00134B2 HVX00234B2 HVX00334B2 HVX00534B2 HVX00734B2**	
FR5	FB10	208V AC	5 7-1/2 10	17.5 25 31	**HVX00511B2 HVX00711B2 HVX01011B2**		**HVX00521B2 HVX00721B2 HVX01021B2**		**HVX00531B2 HVX00731B2 HVX01031B2**	
		230V AC	5 7-1/2 10	17.5 25 31	**HVX00512B2 HVX00712B2 HVX01012B2**		**HVX00522B2 HVX00722B2 HVX01022B2**		**HVX00532B2 HVX00732B2 HVX01032B2**	
		480V AC	10 15 20	16 23 31	**HVX01014B2 HVX01514B2 HVX02014B2**		**HVX01024B2 HVX01524B2 HVX02024B2**		**HVX01034B2 HVX01534B2 HVX02034B2**	
FR6	FB10	208V AC	15 20	48 61	**HVX01511B2 HVX02011B2**		**HVX01521B2 HVX02021B2**		**HVX01531B2 HVX02031B2**	
		230V AC	15 20	48 61	**HVX01512B2 HVX02012B2**		**HVX01522B2 HVX02022B2**		**HVX01532B2 HVX02032B2**	
		480V AC	25 30 40	38 46 61	**HVX02514B2 HVX03014B2 HVX04014B2**		**HVX02524B2 HVX03024B2 HVX04024B2**		**HVX02534B2 HVX03034B2 HVX04034B2**	
FR7	FB10	208V AC	25 30	75 88	**HVX02511N2 HVX03011N2**		**HVX02521N2 HVX03021N2**		**HVX02531N2 HVX03031N2**	
		230V AC	25 30	75 88	**HVX02512N2 HVX03012N2**		**HVX02522N2 HVX03022N2**		**HVX02532N2 HVX03032N2**	
		480V AC	50 60 75	72 87 105	**HVX05014N2 HVX06014N2 HVX07514N2**		**HVX05024N2 HVX06024N2 HVX07524N2**		**HVX05034N2 HVX06034N2 HVX07534N2**	
FR8	FB10	208V AC	40 50 60	114 143 169	— — —		**HVX04021N2** ① **HVX05021N2 HVX06021N2**		**HVX04031N2** ① **HVX05031N2 HVX06031N2**	
		230V AC	40 50 60 75	104 130 154 192	— — — —		**HVX04022N2** ① **HVX05022N2 HVX06022N2 HVX07522N2**		**HVX04032N2** ① **HVX05032N2 HVX06032N2 HVX07532N2**	
		480V AC	100 125 150	124 156 180	— — —		**HVX10024N2 HVX12524N2 HVX15024N2**		**HVX10034N2 HVX12534N2 HVX15034N2**	

① 40 hp 208V and 230V supplied as a FR7 drive, but in a C-Box.

40

Discount Symbol **SS-6**

Table 40-302. Option Pricing

Voltage	hp (I_L)	Description	Suffix Number	Adder U.S. $
208V	1 – 7-1/2 10 15 20 30 ① 40 50 60	Drive Isolation Fusing	**P3** ②	
230V	1 – 7-1/2 10 15 20 30 40 50 60 75	Drive Isolation Fusing	**P3** ②	
480V	1 – 15 20 25 30 40 50 60 75 ① 100 125 150	Drive Isolation Fusing	**P3** ②	
208/230V AC	1 – 3 5 – 7-1/2 10 15 20 25 30	3rd Contactor Drive Isolation	**P6** ②③	
	40 50 60 75 ④			
480V AC	1 – 7-1/2 10 – 15 20 25 30	3rd Contactor Drive Isolation	**P6** ②③	
	40 50 60 75			
	100 125 150			

① Fused Drive Isolation (**P3**) is not available in NEMA Type 1 Design in 208V 30 hp and 480V 75 hp.
② Fused Drive Isolation (**P3**) and 3rd Contactor Drive Isolation (**P6**) cannot be installed together in NEMA Type 1 Design.
③ **P6** option only available with IntelliPass Drives.
④ 75 hp only available on 230V units.

Table 40-302. Option Pricing (Continued)

Voltage	hp (I_L)	Description	Suffix Number	Adder U.S. $
208/230V AC	1 – 3 5 – 7-1/2 10 15 20 25	Output Contactor	**PE** ⑦	
	30 40 50 60 75 ⑤			
480V AC	1 – 7-1/2 10 – 15 20 25 30 40	Output Contactor	**PE** ⑦	
	50 60 75 100 125 150			
208/230V AC	1 – 30	Auxiliary Contacts, (2) Factory Installed	**K9** ⑧	
480V AC	1 – 75	Auxiliary Contact, (1) Not Installed	⑥	
		Auxiliary Contacts, (2) Factory Installed	**K9** ⑧	

⑤ 75 hp only available on 230V units.
⑥ Catalog Number **EMA13**.
⑦ **PE** option only available with IntelliDisconnect Drives.
⑧ **K9** option only available with IntelliPass Drives.

Table 40-303. Enclosure Option

Description	Factory Installed	
	Suffix Number	Adder U.S. $
Space Heater ⑨	**SA**	
Floor Stand 22" ⑩	**S5**	

⑨ Space Heater (**SA**) only applicable in NEMA Type 12/3R enclosures.
⑩ **S5** option only available in enclosure size C in Type 12/3R enclosures.

Discount Symbol **SS-6**

HVX9000 IntelliPass Option Boards

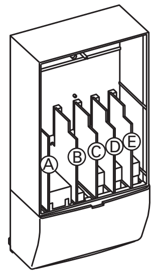


Figure 40-99. HVX9000 IntelliPass Option Boards

The HVX9000 IntelliPass Series drives can accommodate a wide selection of expander and adapter option boards to customize the drive for your application needs. The drive's control unit is designed to accept a total of five option boards. See **Figure 40-99**.

The HVX9000 IntelliPass factory installed standard option board configuration includes an A9I/O board, A2 relay output board and a B5 output board which are installed in slots A, B and C respectively. Two slots (D, E) for extended I/O and communication cards.

Table 40-304. Option Board Kits

Option Kit Description ①	Allowed ② Slot Locations	Catalog Number	Kit Price U.S. $	Factory Installed	
				Suffix Number	Adder U.S. $
Basic I/O Cards					
2 RO	B	**OPTA2**		Standard	
6 DI, 1 DO 2 AI, 1 AO small terminal block	A	**OPTA9**		Standard	
3 RO	C	**OPTB5**		Standard	
Extended I/O Cards					
1 AI, 2 AO	C, **D**	**OPTB4**		**B4**	
3 RO	C, **D**	**OPTB5**		**B5**	
Communication Cards ③					
Modbus	D, **E**	**OPTC2**		**C2**	
Lonworks	D, **E**	**OPTC4**		**C4**	
Johnson Controls N2	D, **E**	**OPTC2**		**CA**	
Siemens Apogee FLN	D, **E**	**OPTCB**		**CB**	
BacNet	D, **E**	**OPTCJ**		**CJ**	

① AI = Analog Input; AO = Analog Output; DI = Digital Input; DO = Digital Output; RO = Relay Output.
② Option card must be installed in one of the slots listed for that card. Slot indicated in bold is the preferred location.
③ Only one communication card can be installed.

Accessories

Table 40-305. HVX9000 Drive Accessories

Description	Catalog Number	Price U.S. $
9000X Drive Demo	**9000XDEMO**	
Hand Held 24V Auxiliary Power Supply — used to supply power to the control module in order to perform keypad programming before the drive is connected to line voltage	**9000XAUX24V**	

Dimensions

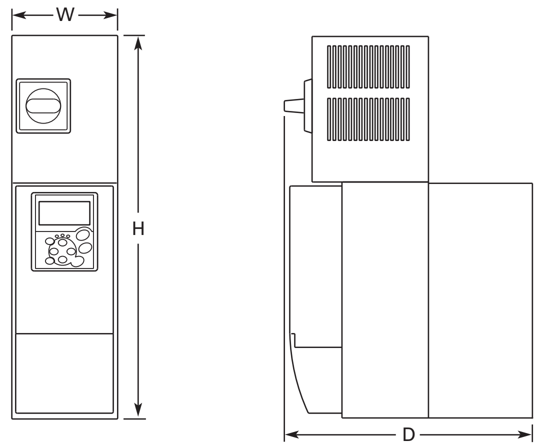


Figure 40-100. NEMA Type 1 IntelliPass/IntelliDisconnect Drive Dimensions

Table 40-306. NEMA Type 1 IntelliPass/IntelliDisconnect Drive Dimensions

Frame Size	Voltage AC	hp (I_L)	Approximate Dimensions in Inches (mm)			Weight Lbs. (kg)
			H	W	D	
4	208 230 480	1 – 3 1 – 3 1 – 7-1/2	18.32 (465)	5.05 (128)	12.45 (316)	21.0 (10.0)
5	208 230 480	5 – 10 5 – 10 10 – 20	23.68 (601)	5.40 (137)	15.34 (390)	35.0 (16.0)
6	208 230 480	15, 20 15, 20 25 – 40	30.25 (768)	7.5 (191)	15.02 (382)	67.0 (30.0)
7	208 230 480	25, 30 25, 30 50 – 75	38.27 (972)	9.1 (231)	15.02 (382)	108 (49)

Enclosure Box A NEMA Type 12

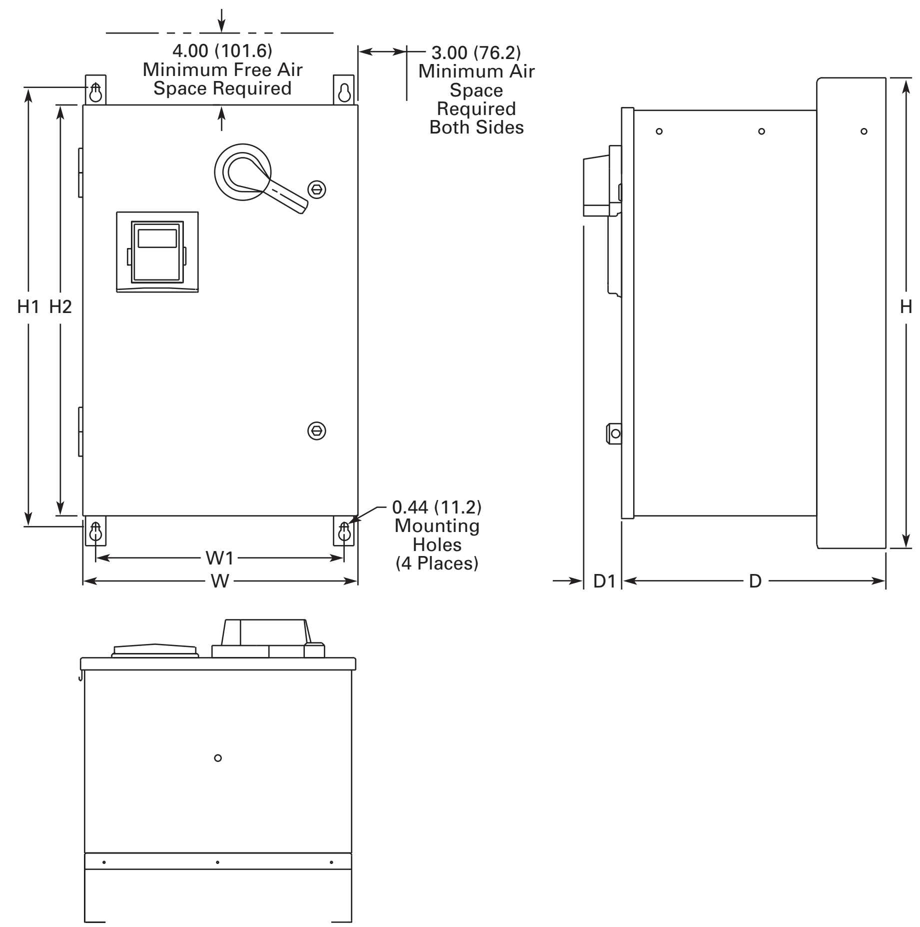


Figure 40-101. NEMA Type 12 IntelliPass/IntelliDisconnect Drive Dimensions

Table 40-307. NEMA Type 12 IntelliPass/IntelliDisconnect Drive Dimensions

Voltage AC	hp (I_L)	Approximate Dimensions in Inches (mm)							Approx. Weight Lbs. (kg)	Approx. Ship Weight Lbs. (kg)
		H	H1	H2	W	W1	D	D1		
208V	1 – 15	29.00 (736.6)	27.00 (685.8)	25.35 (643.9)	16.92 (429.8)	15.30 (388.6)	16.26 (413.0)	2.34 (59.4)	120 (54)	160 (73)
230V	1 – 15									
480V	1 – 30									

Enclosure Box B NEMA Type 12

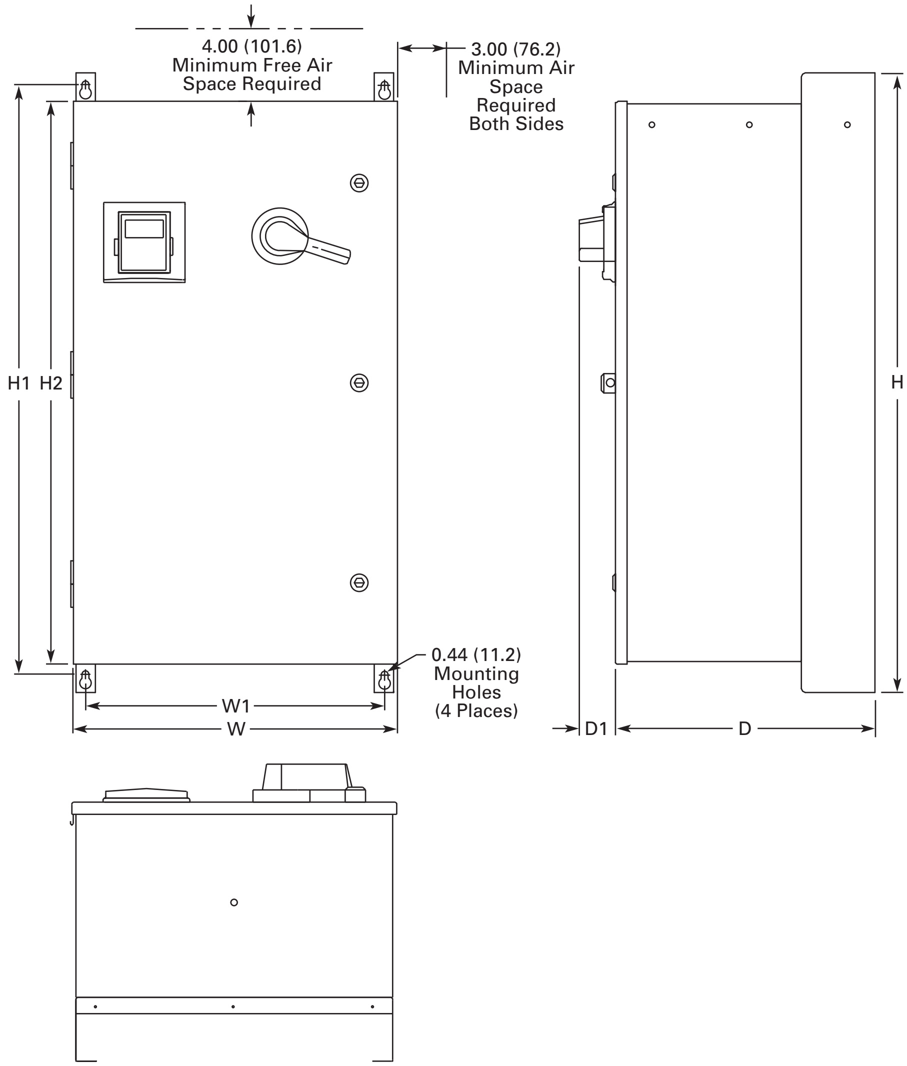


Figure 40-102. NEMA Type 12 IntelliPass/IntelliDisconnect Drive Dimensions

Table 40-308. NEMA Type 12 IntelliPass/IntelliDisconnect Drive Dimensions

Voltage AC	hp (I_L)	Approximate Dimensions in Inches (mm)							Approx. Weight Lbs. (kg)	Approx. Ship Weight Lbs. (kg)
		H	H1	H2	W	W1	D	D1		
208V	20 – 30	40.00 (1016.0)	38.00 (965.2)	36.35 (923.3)	20.92 (531.4)	19.30 (490.2)	16.76 (425.7)	2.34 (59.4)	185 (84)	229 (104)
230V	20 – 30									
480V	40 – 75									

Enclosure Box C NEMA Type 12

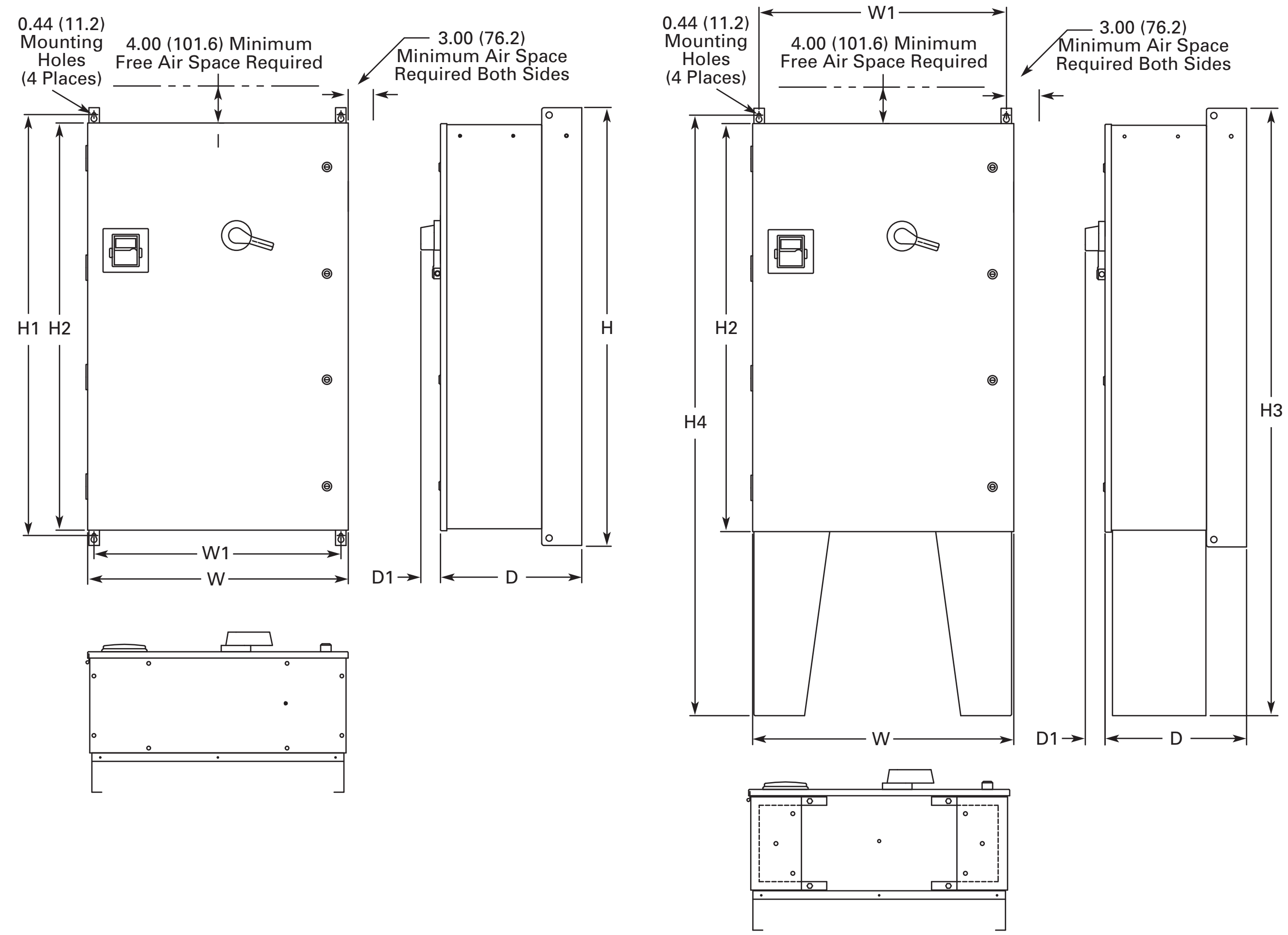


Figure 40-103. NEMA Type 12 IntelliPass/IntelliDisconnect Drive Dimensions

Table 40-309. NEMA Type 12 IntelliPass/IntelliDisconnect Drive Dimensions

Voltage AC	hp (I_L)	Approximate Dimensions in Inches (mm)									Approx. Weight Lbs. (kg)
		H	H1	H2	H3	H4	W	W1	D	D1	
208V	40 – 60	52.00 (1320.8)	50.00 (1270.0)	48.35 (1228.1)	72.00 (1828.8)	71.19 (1808.2)	30.92 (785.4)	29.30 (744.2)	16.78 (426.2)	2.34 (59.4)	①
230V	40 – 75										
480V	100 – 150										

① Consult Factory.

Enclosure Box A NEMA Type 3R

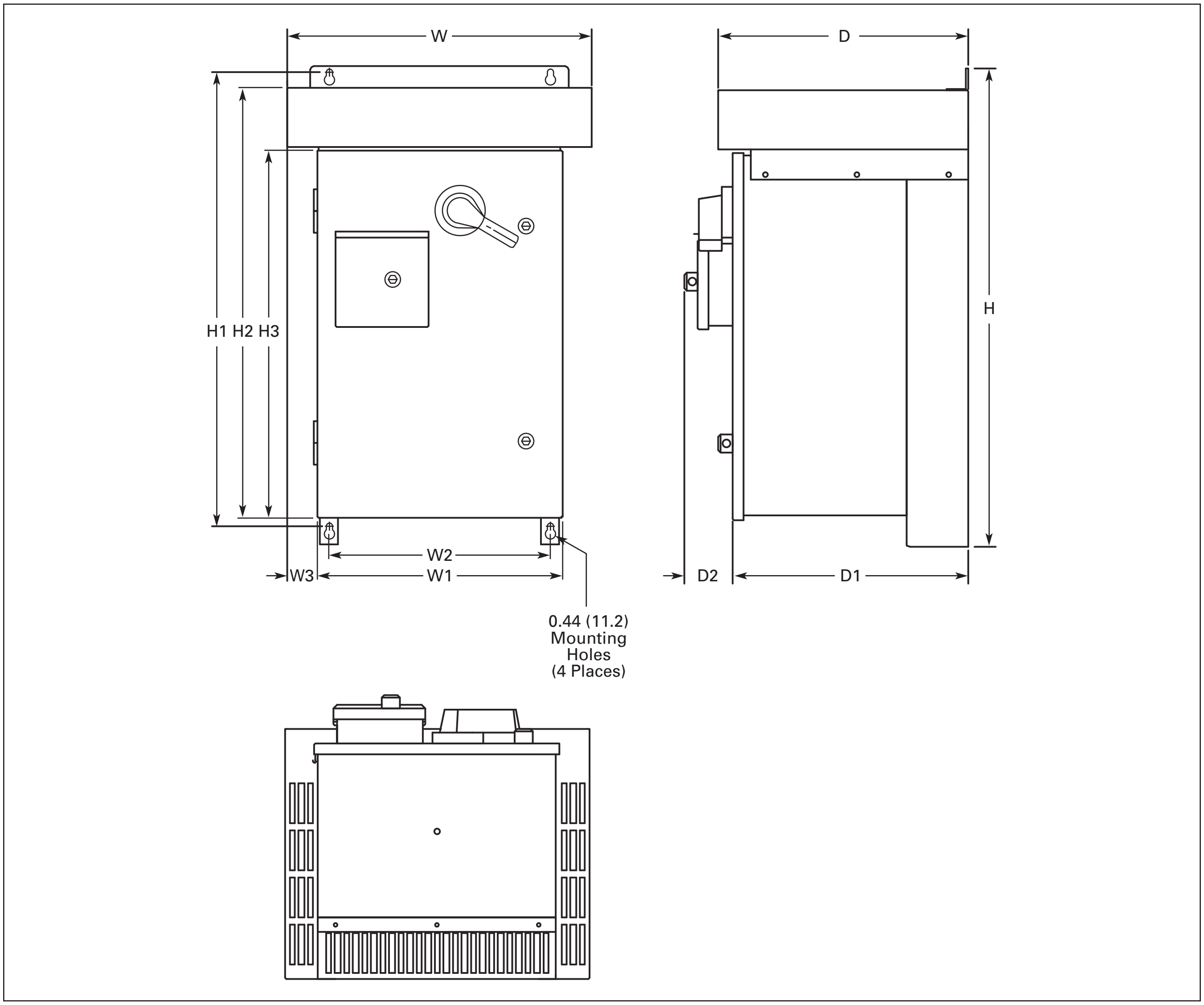


Figure 40-104. NEMA Type 3R IntelliPass/IntelliDisconnect Drive Dimensions

Table 40-310. NEMA Type 3R IntelliPass/IntelliDisconnect Drive Dimensions

Voltage AC	hp (I_L)	Approximate Dimensions in Inches (mm)											Approx. Weight Lbs. (kg)	Approx. Ship Weight Lbs. (kg)
		H	H1	H2	H3	W	W1	W2	W3	D	D1	D2		
208V	1 – 15	33.00 (838.2)	31.36 (796.5)	29.67 (753.6)	25.35 (643.9)	21.05 (534.7)	16.92 (429.8)	15.30 (388.6)	2.07 (52.6)	17.24 (437.9)	16.26 (413.0)	3.31 (84.1)	170 (77)	215 (98)
230V	1 – 15													
480V	1 – 30													

Enclosure Box B NEMA Type 3R

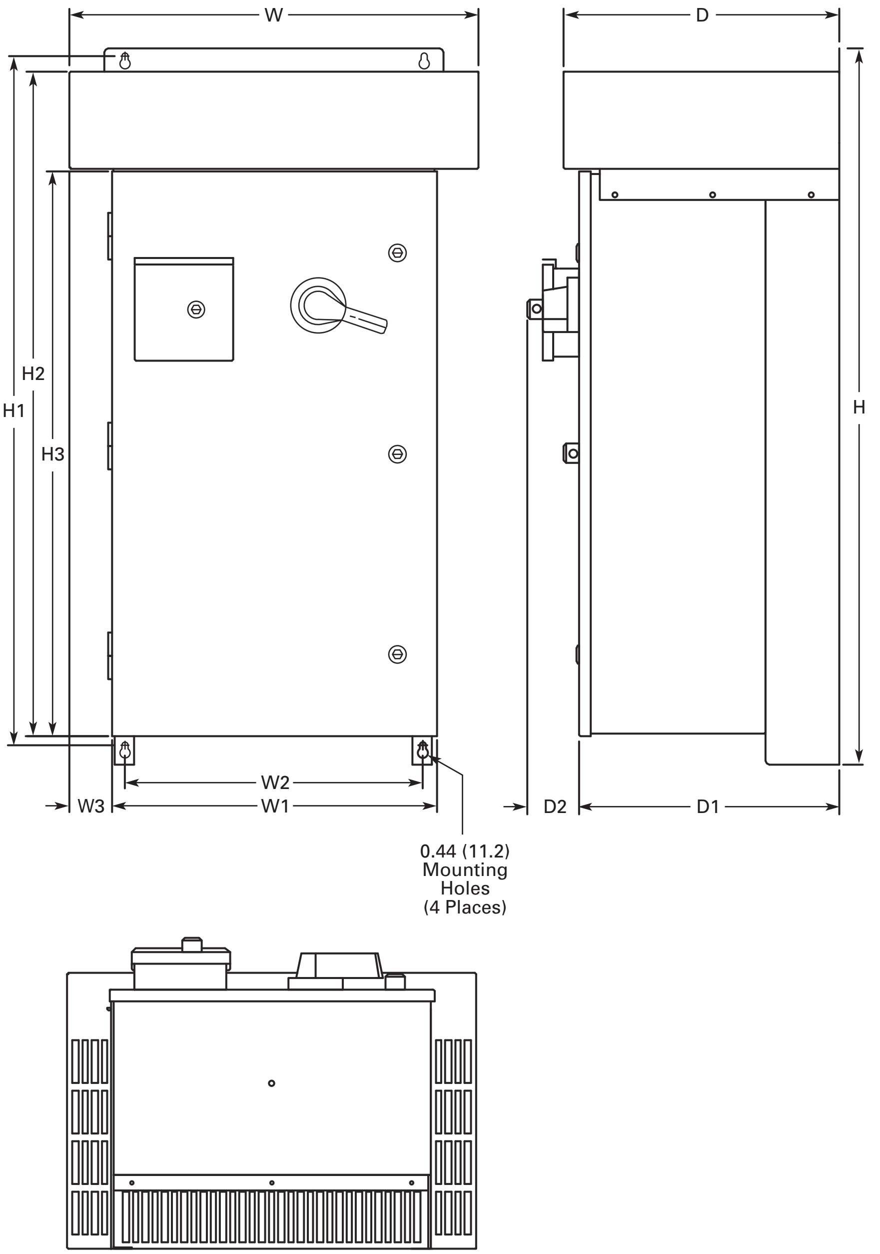


Figure 40-105. NEMA Type 3R IntelliPass/IntelliDisconnect Drive Dimensions

Table 40-311. NEMA Type 3R IntelliPass/IntelliDisconnect Drive Dimensions

Voltage AC	hp (I_L)	Approximate Dimensions in Inches (mm)											Approx. Weight Lbs. (kg)	Approx. Ship Weight Lbs. (kg)
		H	H1	H2	H3	W	W1	W2	W3	D	D1	D2		
208V	20 – 30	46.09 (1170.7)	44.45 (1129.0)	42.77 (1086.4)	36.35 (923.3)	26.31 (668.3)	20.92 (531.4)	19.30 (490.2)	2.69 (68.3)	17.74 (450.6)	16.76 (425.7)	3.31 (84.1)	235 (107)	290 (132)
230V	20 – 30													
480V	40 – 75													

Enclosure Box C NEMA Type 3R

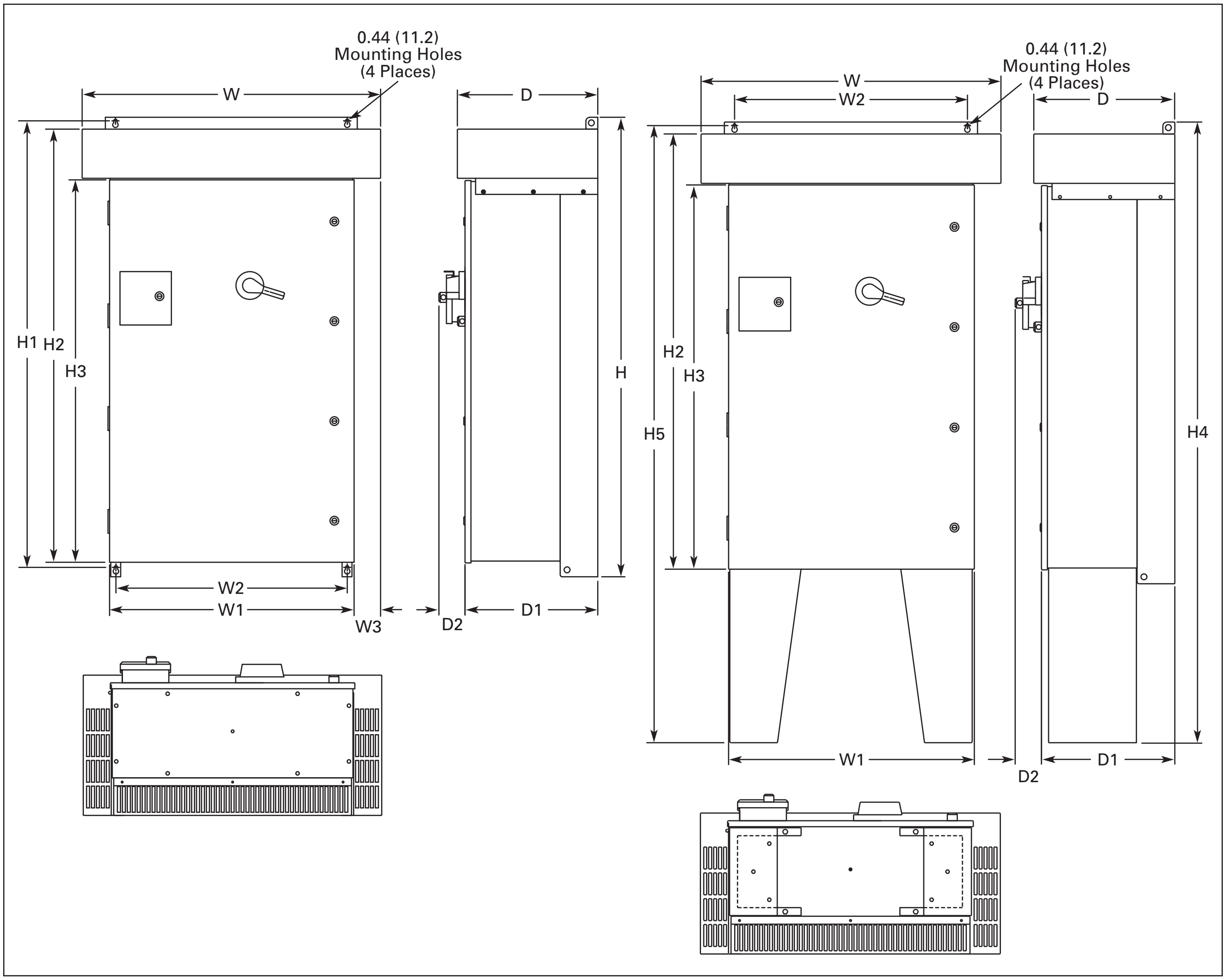


Figure 40-106. NEMA Type 3R IntelliPass/IntelliDisconnect Drive Dimensions

Table 40-312. NEMA Type 3R IntelliPass/IntelliDisconnect Drive Dimensions

Voltage AC	hp (I_L)	Approximate Dimensions in Inches (mm)													Approx. Weight Lbs. (kg)
		H	H1	H2	H3	H4	H5	W	W1	W2	W3	D	D1	D2	
208V	40 – 60	58.09 (1475.5)	56.45 (1433.8)	54.77 (1391.2)	48.35 (1228.1)	78.09 (1983.5)	77.64 (1972.1)	37.73 (958.3)	30.92 (785.4)	29.30 (744.2)	3.34 (84.8)	17.74 (450.6)	16.77 (426.0)	3.31 (84.1)	①
230V	40 – 75														
480V	100 – 150														

① Consult Factory.

Wiring Diagrams

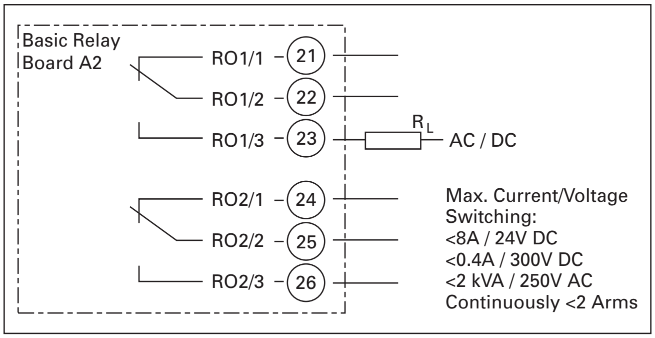


Figure 40-107. A2 Board Control Wiring

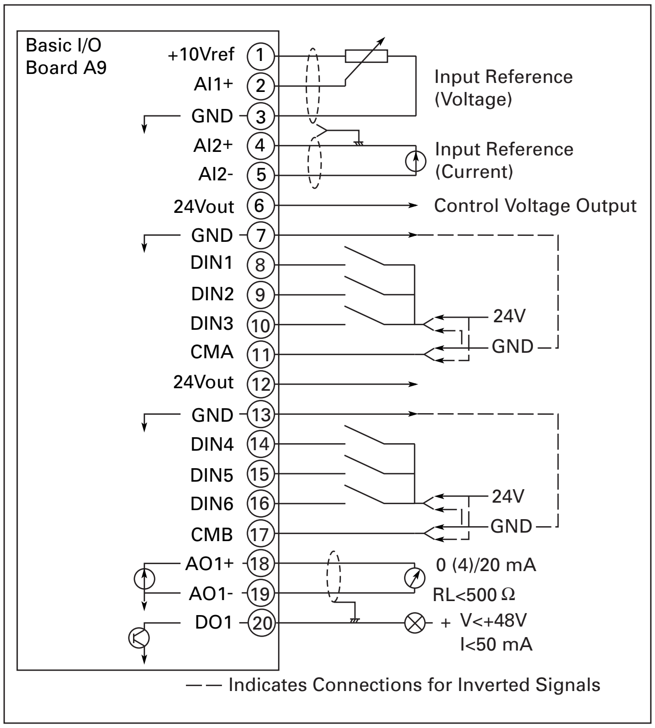


Figure 40-108. A9 Board Control Wiring

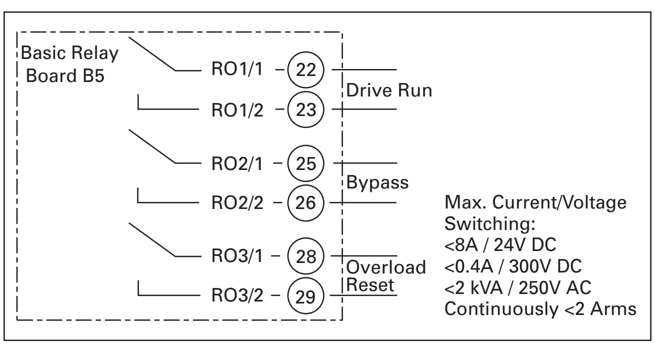


Figure 40-109. B5 Board Control Wiring

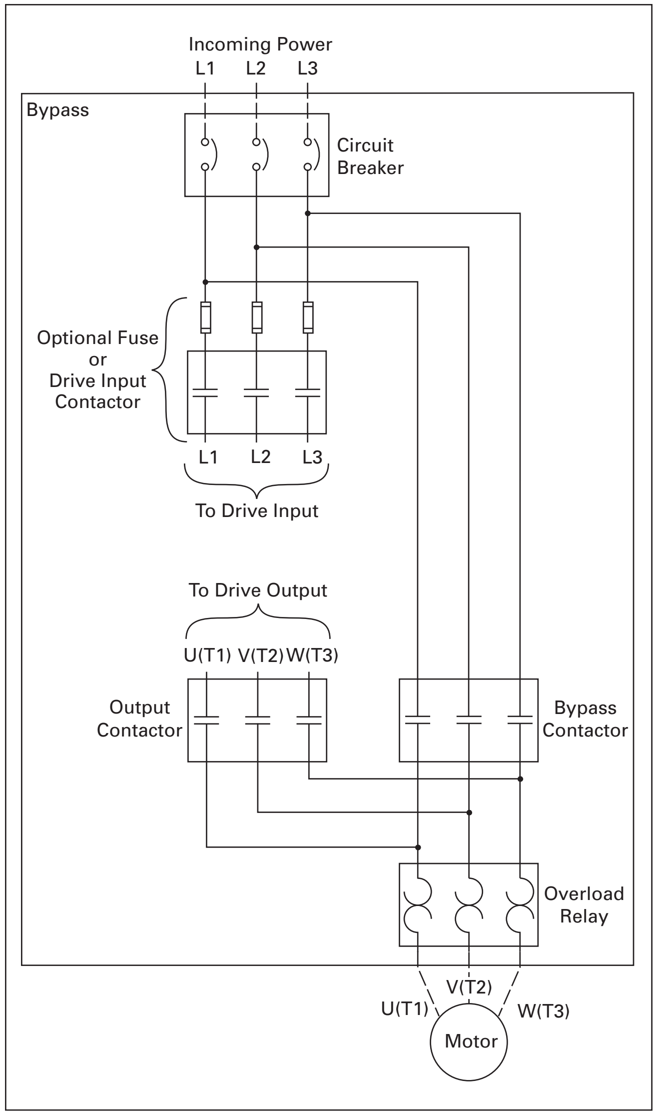


Figure 40-110. HVX9000 IntelliPass Power Wiring

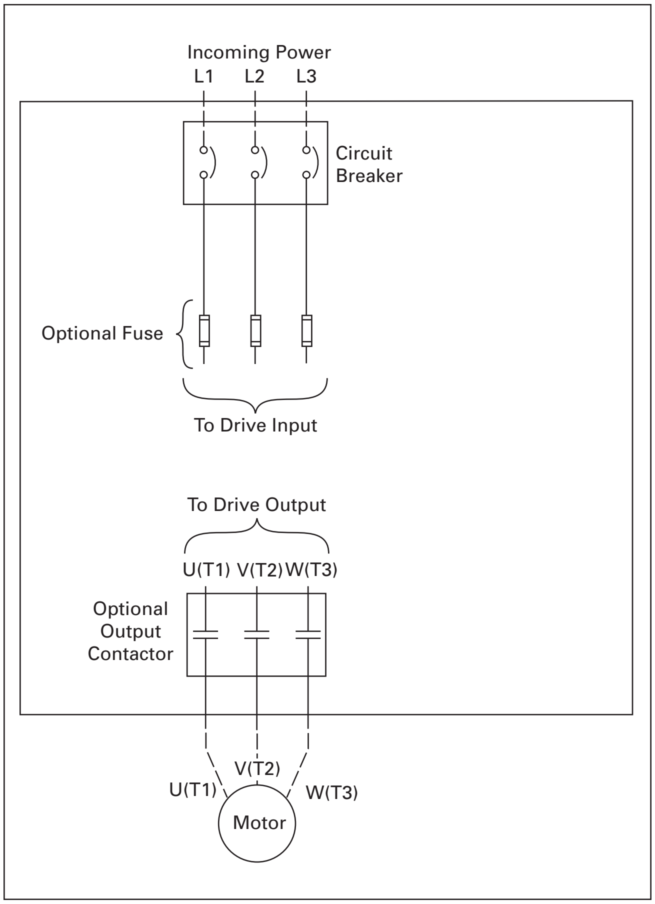


Figure 40-111. HVX9000 IntelliDisconnect Power Wiring

Contents



CFX9000 — UL Type 1, 150 hp I_L

Product Description

The Cutler-Hammer® CFX9000 Clean Power Drives from Eaton's electrical business use tuned passive filters to significantly reduce line harmonics at the drive input terminals.

The CFX9000 drive also delivers True Power Factor — in addition to reducing harmonic distortion, the CFX9000 drive prevents transformer overheating and overloading of breakers and feeders, which enables the application of adjustable frequency drives on generators and other high impedance power systems.

The 9000X Family of Drives includes HVX9000, SVX9000, SLX9000 and SPX9000. 9000X Series drive ratings are rated for either high overload (I_H) or low overload (I_L). I_L indicates 110% overload capacity for 1 minute out of 10 minutes. I_H indicates 150% overload capacity for 1 minute out of 10 minutes.



CFX9000 — UL Type 3R, 40 hp I_L

CFX9000 Enclosed Products Program

- **Standard Enclosed** — covers a wide range of the most commonly ordered options. Pre-engineering eliminates the lead time normally associated with customer specific options. Available configurations are listed on **Pages 40-219 – 40-228.**
- **Modified Standard Enclosed** — applies to specific customer requirements that vary from the Standard Enclosed offering, such as the need for an additional indicating light or minor modifications to drawings. *Contact your local sales office for assistance in pricing and lead time.*
- **Custom Engineered** — for those applications with more unique or complex requirements, these are individually engineered to the customer's needs. *Contact your local sales office for pricing and lead time.*

Features and Benefits

New CFX9000 Integrated Filter Clean Power Drive features include (at 480V):

- 7-1/2 – 40 hp I_L drives available in 21" (W) x 40" (H) enclosure
- 50 – 75 hp I_L drives available in 31" (W) x 52" (H) enclosure
- 100 – 150 hp I_L drives available in 30" (W) x 90" (H) enclosure
- 200 and 250 hp I_L drives available in 48" (W) x 90" (H) enclosure
- 300 – 400 hp I_L drives available in 60" (W) x 90" (H) enclosure
- UL Type 1, UL Type 12, UL Type 3R and NEMA 12 with Gaskets and Filters
- Input Voltage: 480V, 230V, 575V
- Complete range of control, network and power options
- Horsepower range:
  - 480V, 7-1/2 – 400 hp I_L
  - 230V, 7-1/2 – 100 hp I_L; consult factory for details
  - 575V, 15 – 400 hp I_L; consult factory for details
- Single enclosure for both drive and filter reduces field wiring and enables convenient bypass installation
- Packaged solution ensures optimal coordination of drive and filter

Application Description

Designed to meet the IEEE 519-1992 requirements for harmonic distortion, the CFX9000 is an excellent choice for small and midsize drives applications where harmonics are a concern.

What Are Harmonics?

Take a perfect wave with a fundamental frequency of 60 Hz, which is close to what is supplied by the power company.

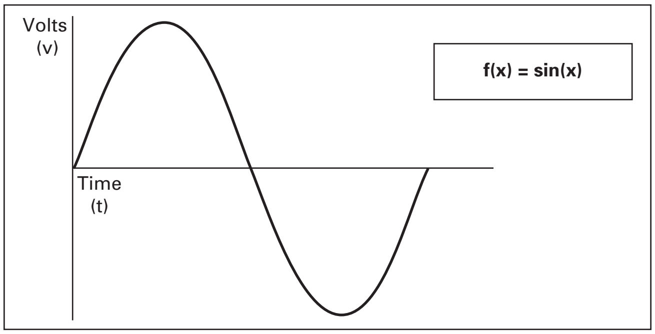


Figure 40-112. Perfect Wave

Add a second wave that is five times the fundamental frequency — 300 Hz (Typical of frequency added to the line by a fluorescent light).

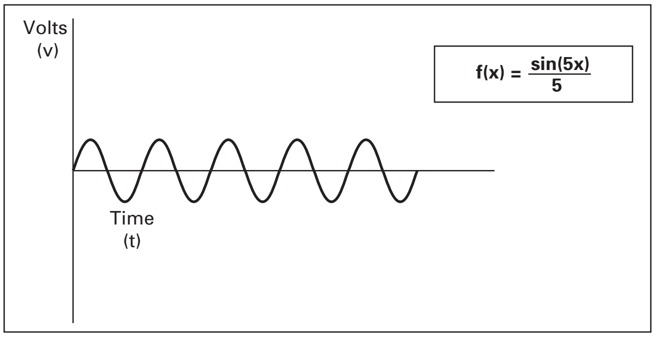


Figure 40-113. Second Wave

Combine the two waves. The result is a 60 Hz supply rich in fifth harmonics.

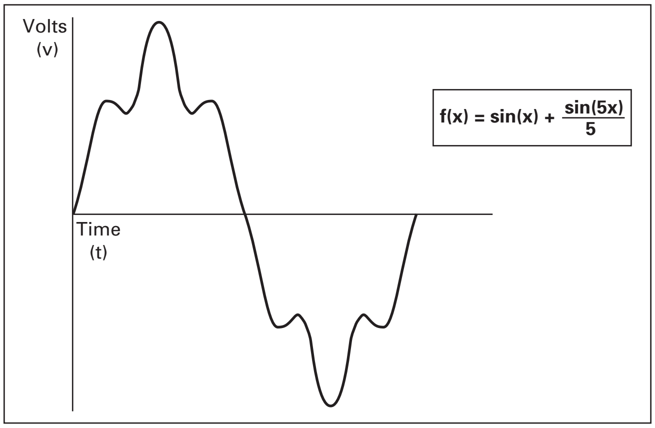


Figure 40-114. Resulting Supply

What Causes Harmonics?

Harmonics are the result of nonlinear loads that convert AC line voltage to DC. Examples of equipment that are non-linear loads are listed below:

- AC variable frequency drives
- DC drives
- Fluorescence lighting, computers, UPS systems
- Industrial washing machines, punch presses, welders, etc.

How Can Harmonics Due to VFDs Be Diminished?

By applying drives from the Eaton Clean Power Drives Family; The HCX9000, CFX9000 and CPX9000.

What Are Linear Loads?

Linear loads are primarily devices that run across the line and do not add harmonics. Motors are prime examples. The downside to having large motor linear loads is that they draw more energy than a VFD, because of their inability to control motor speed. In most applications there is a turn down valve used with the motor which will reduce the flow of the material, without significantly reducing the load to the motor. While this provides some measure of speed control, it is extremely inefficient.

Why Be Concerned About Harmonics?

1. ***Installation and utility costs increase.*** Harmonics cause damage to transformers and lower efficiencies due to the IR loss. These losses can become significant (from 16.6 – 21.6%) which can have a dramatic effect on the HVAC systems that are controlling the temperatures of the building where the transformer and drive equipment reside.
2. ***Downtime and loss of productivity.*** Telephones and data transmissions links may not be guaranteed to work on the same power grids polluted with harmonics.
3. ***Downtime and nuisance trips of drives and other equipment.*** Emergency generators have up to (3) three times the impedance that is found in a conventional utility source. Thus the harmonic voltage can be up to three times as large, causing risk of operation problems.
4. ***Larger motors must be used.*** Motors running across the line that are connected on polluted power distribution grids can overheat or operate at lower efficiency due to harmonics.
5. ***Higher installation costs.*** Transformers and power equipment must be oversized to accommodate the loss of efficiencies. This is due to the harmonic currents circulating through the distribution without performing useful work.

How Does a VFD Convert 3-Phase AC to a Variable Output Voltage and Frequency?

The 6-pulse VFD: The majority of all conventional drives that are built consist of a 6-pulse configuration. **Figure 40-115** represents a 6-diode rectifier design that converts three-phase utility power to DC. The inverter section uses IGBTs to convert DC power to a simulated AC sine wave that can vary in frequency from 0 – 400 Hz.

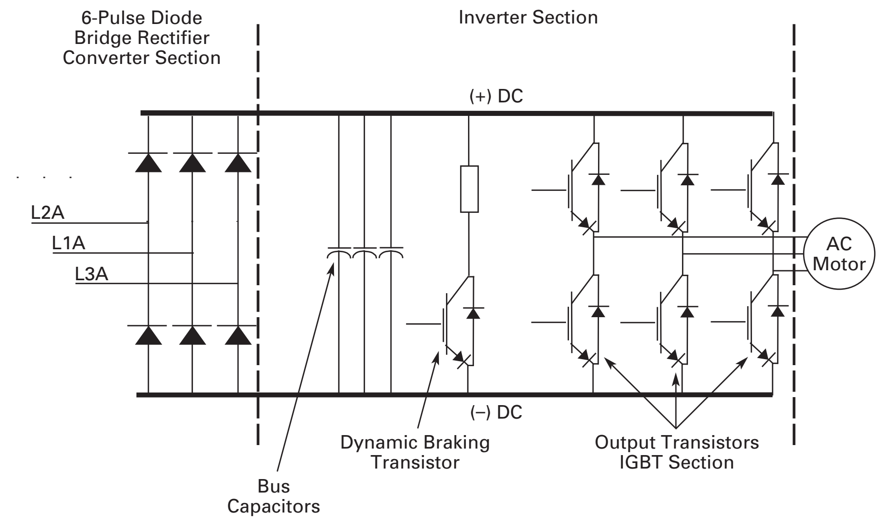


Figure 40-115. 6-Diode Rectifier Design

The 6-Pulse VFD drive creates harmonic current distortion. The harmonic current that is created is energy that can not be used by customers and causes external heat and losses to all components including other drives that are on the same power distribution. **Figure 40-116** is a 100 hp drive with 45A of damaging harmonic current.

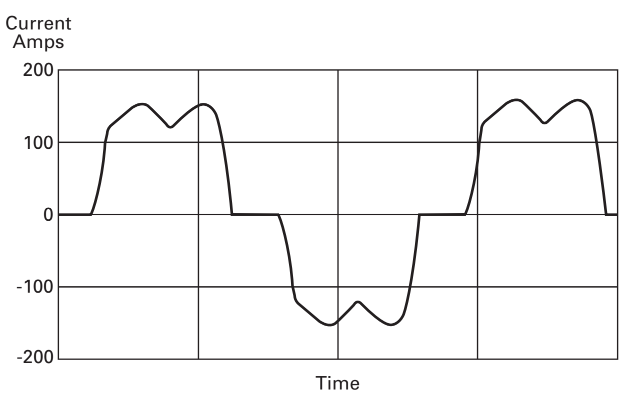


Figure 40-116. 6-Pulse Nonproductive Harmonic Current

Table 40-313. 6-Pulse Nonproductive Harmonic Current

6-Pulse Circuit		
Current Harmonics		
I_1 = 100%	I_{11} = 6.10%	I_{19} = 1.77%
I_5 = 22.5%	I_{13} = 4.06%	I_{23} = 1.12%
I_7 = 9.38%	I_{17} = 2.26%	I_{25} = 0.86%
Power = 100 hp		
Harmonic Current = 45 Amps		

Guidelines of Meeting IEEE Std. 519-1992 Harmonic Distortion Limits

The IEEE 519-1992 Specification is a standard that provides guidelines for commercial and industrial users that are implementing medium and low voltage equipment.

Table 40-314. Maximum Harmonic Current Distortion in % of the Fundamental (120V through 69,000V)

I_{sc}/I_L	Harmonic Order (Odd Harmonics)					TDD
	h<11	11≤h<17	17≤h<23	23≤h<35	35≤h	
<20	4.0	2.0	1.5	0.6	0.3	5.0
20<50	7.0	3.5	2.5	1.0	0.5	8.0
50<100	10.0	4.5	4.0	1.5	0.7	12.0
100<1000	12.0	5.5	5.0	2.0	1.0	15.0
>1000	15.0	7.0	6.0	2.5	1.4	20.0

The ratio ISC/IL is the ratio of the short-circuit current available at the point of common coupling (PCC), to the maximum fundamental load current. Consequently, as the size of the user load decreases with respect to the size of the system, the percentage of harmonic current that the user is allowed to inject into the utility system increases.

Notes:

TDD = Total demand distortion is the harmonic current distortion in percent of the maximum demand load current (15 or 30 minute demand).

I_{SC} = Maximum short circuit current at the PCC not counting motor contribution.

I_L = Maximum demand load current for all of the connected loads (fundamental frequency component) at the PCC.

All of the limits are measured at a point of common coupling.

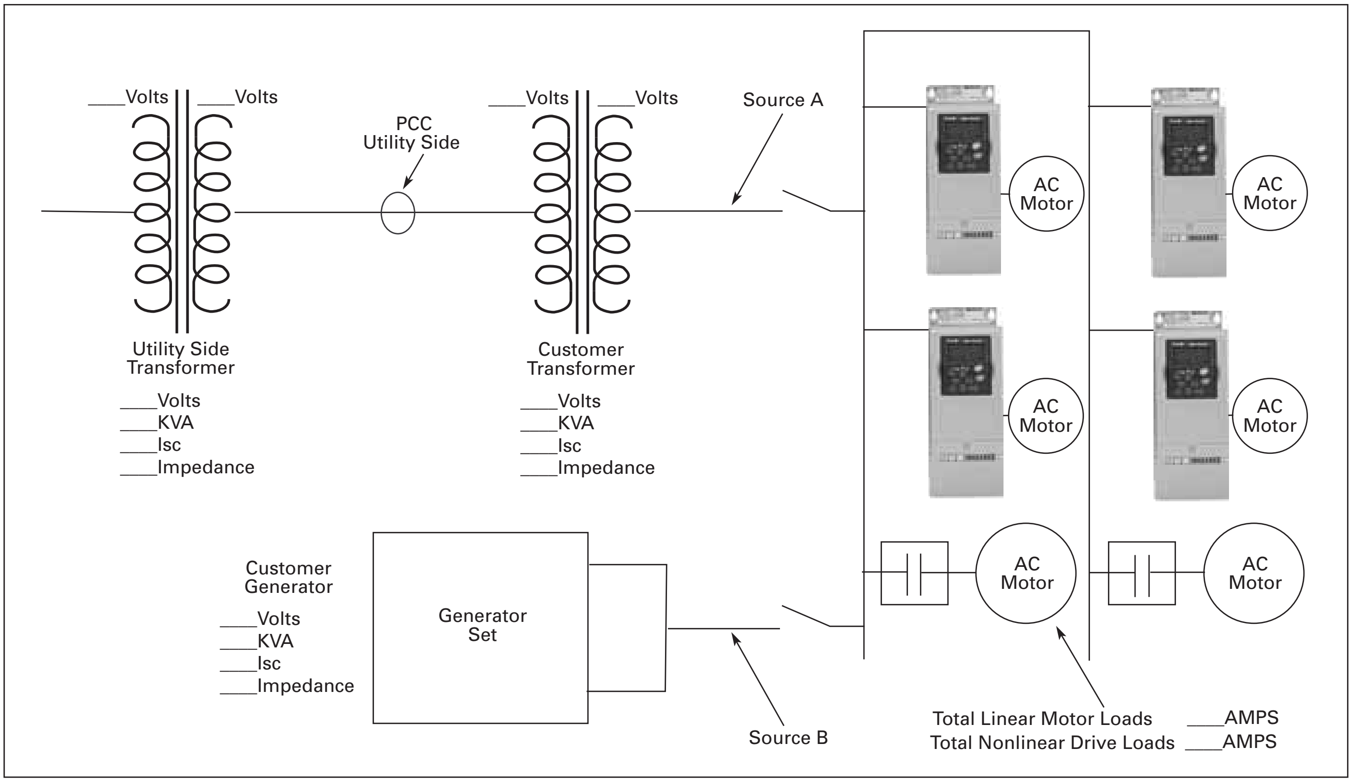


Figure 40-117. Oneline Diagram for Harmonic Analysis

The best way to estimate AFD harmonic contribution to an electrical system is to perform a harmonic analysis based on known system characteristics. The oneline in this Figure would provide the data to complete the calculations.

Terms

- PCC (Point of Common Coupling) is defined as the electrical connecting point between the utility and multiple customers per the specifications in IEEE 519.
- POA (Point of Analysis) is defined as where the harmonic calculations are taken.

An oscilloscope can make all measurements at the PCC or POA to do an on-site harmonic evaluation.

Harmonic Reduction Methods to Meet IEEE 519

1. Line Reactor

A line reactor is a 3-phase series inductance on the line side of an AFD. If a line reactor is applied on all AFDs, it is possible to meet IEEE guidelines where 10 – 25% of system loads are AFDs, depending on the stiffness of the line and the value of line reactance. Line reactors are available in various values of percent impedance, most typically 1 – 1.5%, 3% and 5%. (Note: the 9000X drives come standard with a nominal 3% input impedance.)

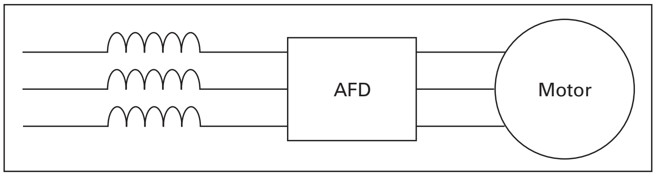


Figure 40-118. Line Reactor

Advantages

- Low cost
- Can provide moderate reduction in voltage and current harmonics
- Available in various values of percent impedance
- Provides increased input protection for AFD and its semiconductors from line transients

Disadvantages

- May not reduce harmonic levels to below IEEE 519-1992 guidelines
- Voltage drop due to IR loss

2. Passive Filters

Tuned harmonic filters involve the series connection of an inductor with the shunt connection of an inductor and capacitor to form a low impedance path to ground for a specific range of frequencies. This path presents an alternative to the flow of harmonic currents back into the utility source.

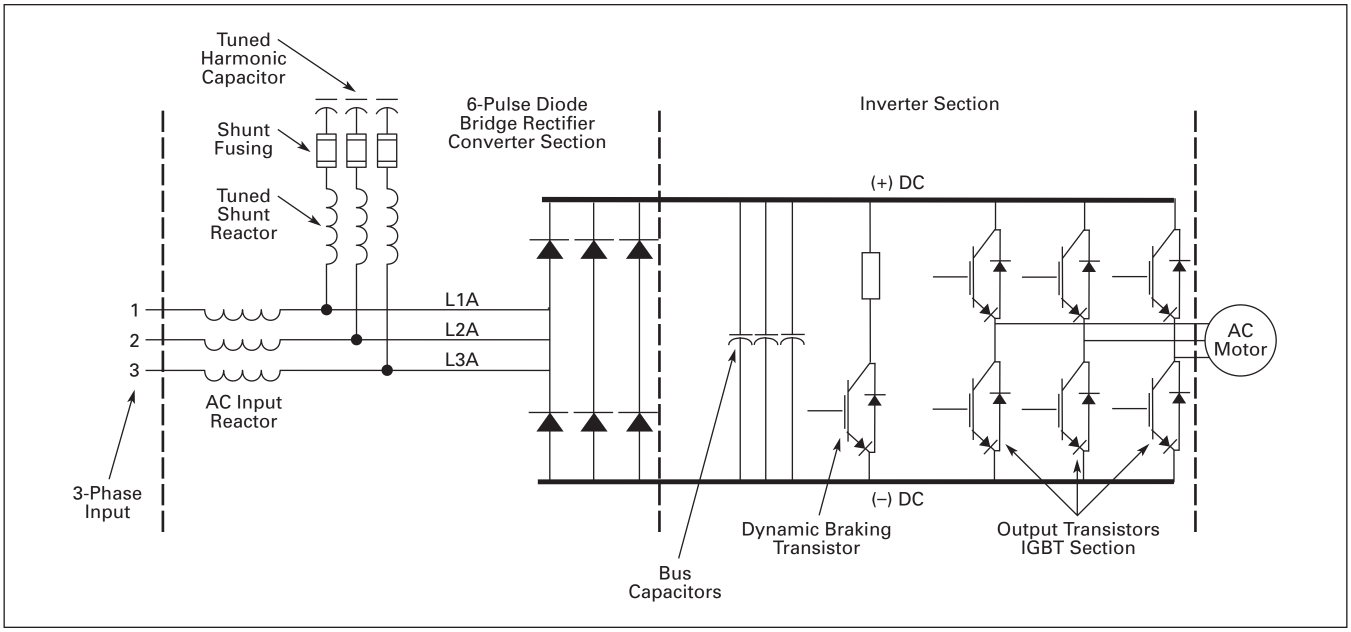


Figure 40-119. CFX9000 Drive with Integrated Passive Filter

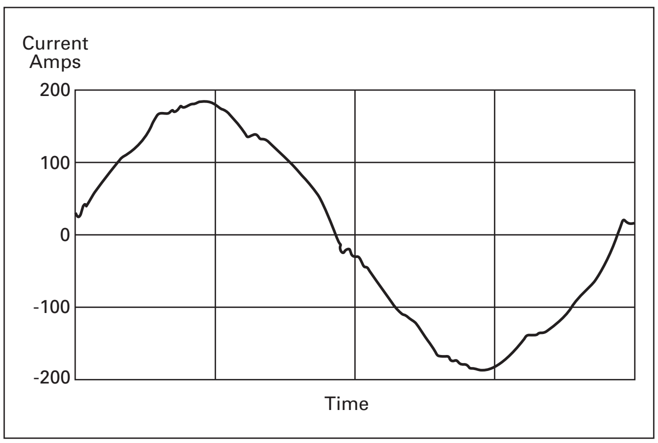


Figure 40-120. 100 hp CFX9000 480V Drive with Integrated Passive Filter

Table 40-315. 100 hp CFX9000 480V Drive with Integrated Passive Filter

Passive Filter		
Current Harmonics		
I_1 = 100%	I_{11} = .24%	I_{19} = .50%
I_5 = 3.76%	I_{13} = 1.1%	I_{23} = .55%
I_7 = 1.65%	I_{17} = .80%	I_{25} = 0.8%
Power = 74.6 kW		
H_C = 8.6 Amps		

Advantages

- Low cost for smaller horsepower applications
- More effective harmonic attenuation than 12-pulse drives
- Provides increased input protection for AFD from line transients

Disadvantages

- Capacitors age over time, unlike magnetics
- Not as effective as 18-pulse drives
- Challenging to retrofit with bypass applications

3. 12-Pulse Converters

A 12-pulse converter incorporates two separate AFD input semiconductor bridges, which are fed from 30° phase shifted power sources with identical impedance. The sources may be two isolation transformers, where one is a delta/wye design (which provides the phase shift) and the second a delta/delta design (which does not phase shift). The 12-pulse arrangement allows the harmonics from the first converter to cancel the harmonics of the second. Up to approximately 85% reduction of harmonic current and voltage distortion may be achieved (over standard 6-pulse converter). This permits a facility to use a larger percentage of AFD loads under IEEE 519-1992 guidelines than allowable using line reactors or DC chokes. A harmonic analysis is required to guarantee compliance with guidelines.

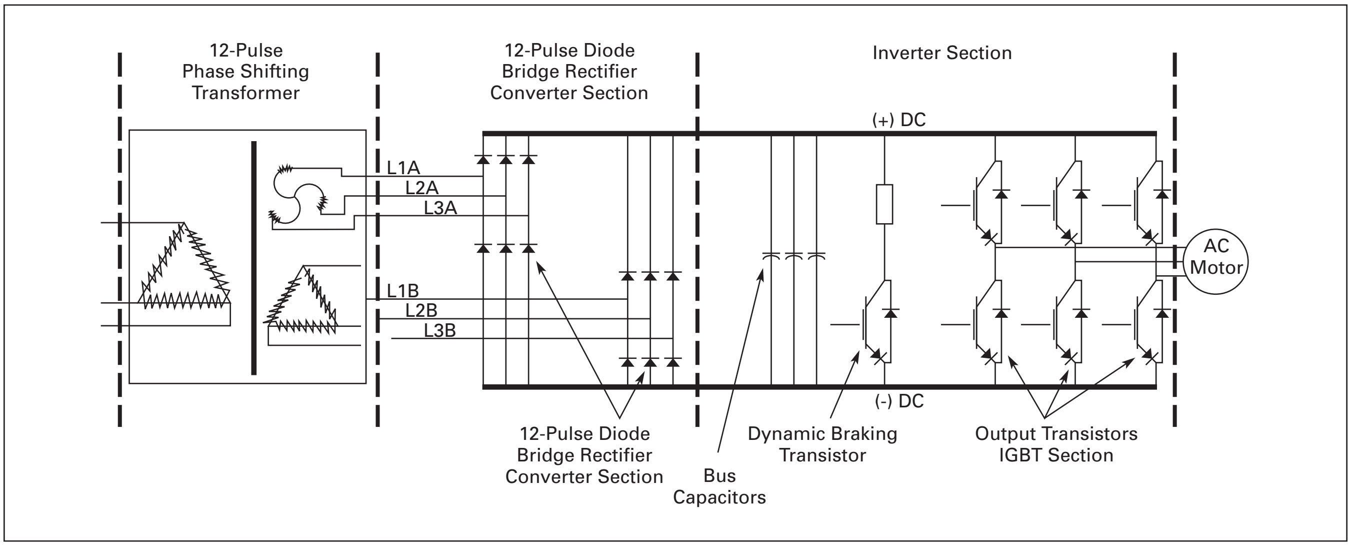


Figure 40-121. Basic 12-Pulse Rectifier with "Phase Shifting" Transformer

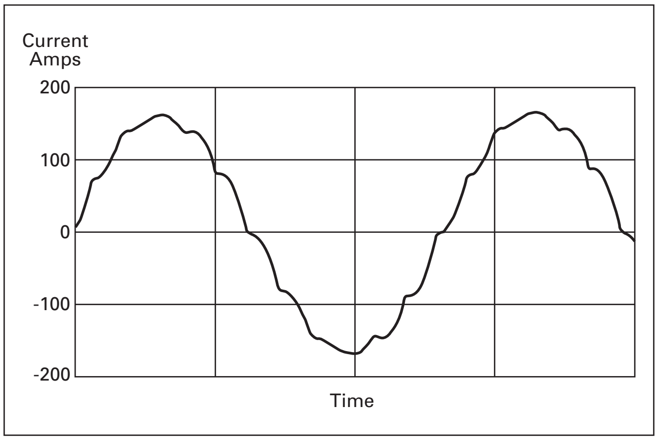


Figure 40-122. 100 hp 480V Drive with 12-Pulse Rectifier

Table 40-316. 100 hp 480V Drive with 12-Pulse Rectifier

12-Pulse Circuit		
Current Harmonics		
I_1 = 100%	I_{11} = 4.19%	I_{19} = 0.06%
I_5 = 1.25%	I_{13} = 2.95%	I_{23} = 0.87%
I_7 = 0.48%	I_{17} = 0.21%	I_{25} = 0.73%
Power = 100 hp		
H_c = 20 Amps		

Advantages

- Reasonable cost, although significantly more than reactors or chokes
- Substantial reduction (up to approx. 85%) in voltage and current harmonics
- Provides increased input protection for AFD and its semiconductors from line transients

Disadvantages

- Impedance matching of phase shifted sources is critical to performance
- Transformers often require separate mounting or larger AFD enclosures
- May not reduce distribution harmonic levels to below IEEE 519-1992 guidelines
- Cannot retrofit for most AFDs

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4. Clean Power 18-Pulse Drives

When the total load is comprised of non-linear load such as drives and the ratio is Isc/I_L, the greatest harmonic mitigation is required. Under these conditions, the currents drawn from the supply need to be sinusoidal and "clean" such that system interference and additional losses are negligible. The Cutler-Hammer CPX9000 Clean Power Drive uses a phase-shifting auto transformer with delta-connected winding that carries only the ampere-turns caused by the difference in load currents. This results in nine separate phases. In this type of configuration, the total KVA rating of the transformer magnetic system was only 48% that of the motor load. A traditional isolated transformer system, with multipulse windings, would require the full KVA rating to be supported, which is more common in a MV step-down transformer.

The integrated 18-pulse clean power drive, with near sine wave input current and low harmonics will meet the requirements of IEEE 519-1992 under all practical operating conditions. The comparisons with 6-pulse, passive filter and 12-pulse, systems are shown in **Figures 40-116**, **40-120, 40-122** and **40-124**.

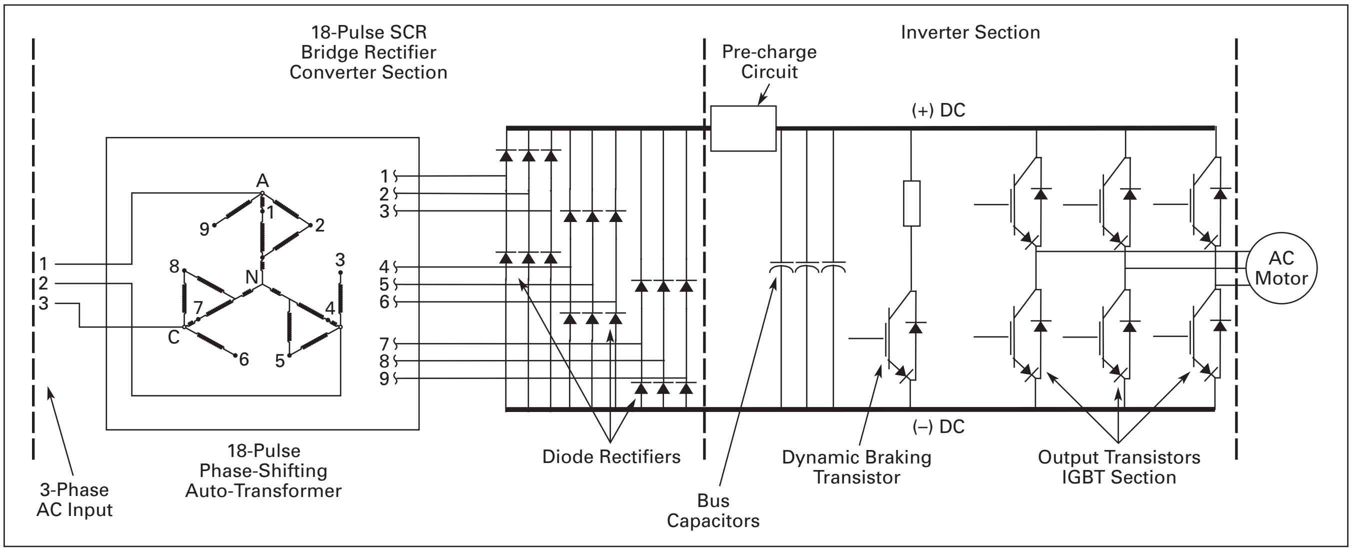


Figure 40-123. Basic 18-Pulse Rectifier with Phase-Shifting Auto-Transformer

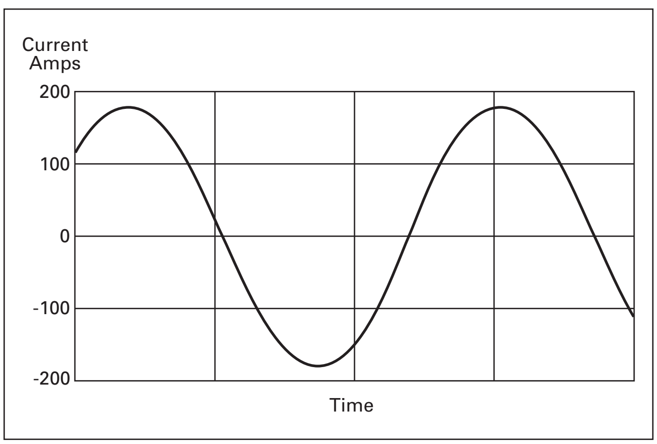


Figure 40-124. 100 hp 480V Drive with 18-Pulse Rectifiers

Table 40-317. 100 hp 480V Drive with 18-Pulse Rectifiers

18-Pulse Clean Power		
Current Harmonics		
I_1 = 100%	I_{11} = 0.24%	I_{19} = 1.00%
I_5 = 0.16%	I_{13} = 0.10%	I_{23} = 0.01%
I_7 = 0.03%	I_{17} = 0.86%	I_{25} = 0.01%
Power = 100 hp		
H_c = 5.9 Amps		

Advantages

- Effectively guarantees compliance with IEEE 519-1992
- Provides increased input protection for AFD and its semiconductors from line transients
- Up to 4 times the harmonic reduction of 12-pulse methods
- Smaller transformer than isolation transformer used in 12-pulse converter
- Minimizes ripple current in capacitors, doubling expected capacitor life

Disadvantages

- Larger and heavier magnetics than some other methods

Technical Data and Specifications

Table 40-318. Specifications

Feature Description	CFX9000 Enclosed Products — UL Type 1, UL Type 12, UL Type 3R and NEMA 12 Filtered
Primary Design Features	
45 – 66 Hz Input Frequency	Standard
Output: AC Volts Maximum	Input Voltage Base
Output Frequency Range: Hz	0 – 320
Initial Output Current (I_H)	250% for 2 seconds
Overload: 1 Minute (I_H/I_L)	150%/110%
Enclosure Space Heater	Optional
Oversize Enclosure	Standard
Output Contactor	Optional
Bypass Motor Starter	Optional
Listings	UL, cUL
Protection Features	
Incoming Line Fuses	Optional
AC Input Circuit Disconnect	Optional
Phase Rotation Insensitive	Standard
EMI Filter	FR6 – FR9 ①
Input Phase Loss Protection	Standard
Input Overvoltage Protection	Standard
Line Surge Protection	Standard
Output Short Circuit Protection	Standard
Output Ground Fault Protection	Standard
Output Phase Protection	Standard
Overtemperature Protection	Standard
DC Overvoltage Protection	Standard
Drive Overload Protection	Standard
Motor Overload Protection	Standard
Programmer Software	Optional
Local/Remote Keypad	Standard
Keypad Lockout	Standard
Fault Alarm Output	Standard
Built-In Diagnostics	Standard
MOV	Optional
Input/Output Interface Features	
Setup Adjustment Provisions:	
Remote Keypad/Display	Standard
Personal Computer	Standard
Operator Control Provisions:	
Drive Mounted Keypad/Display	Standard
Remote Keypad/Display	Standard
Conventional Control Elements	Standard
Serial Communications	Optional
115V AC Control Circuit	Optional
Speed Setting Inputs:	
Keypad	Standard
0 – 10V DC Potentiometer/Voltage Signal	Standard
4 – 20 mA Isolated	Configurable
4 – 20 mA Differential	Configurable
3 – 15 psig	Optional
Analog Outputs:	
Speed/Frequency	Standard
Torque/Load/Current	Programmable
Motor Voltage	Programmable
Kilowatts	Programmable
0 – 10V DC Signals	Configurable w/Jumpers
4 – 20 mA DC Signals	Standard
Isolated Signals	Optional

① The EMI filter is optional in FR10.

Feature Description	CFX9000 Enclosed Products — UL Type 1, UL Type 12, UL Type 3R and NEMA 12 Filtered
Input/Output Interface Features (Continued)	
Discrete Outputs:	
Fault Alarm	Standard
Drive Running	Standard
Drive at Set Speed	Programmable
Optional Parameters	14
Dry Contacts	2 Relays Form C
Open Collector Outputs	1
Additional Discrete Outputs	Optional
Communications:	
RS-232	Standard
RS-422/485	Optional
DeviceNet™	Optional
Modbus RTU	Optional
CanOpen (Slave)	Optional
Profibus-DP	Optional
Lonworks®	Optional
Johnson Controls Metasys™ N2	Optional
Ethernet IP	Optional
BACnet	Optional
Performance Features	
Sensorless Vector Control	Standard
Volts/Hertz Control	Standard
IR and Slip Compensation	Standard
Electronic Reversing	Standard
Dynamic Braking	Optional
DC Braking	Standard
PID Setpoint Controller	Programmable
Critical Speed Lockout	Standard
Current (Torque) Limit	Standard
Adjustable Acceleration/Deceleration	Standard
Linear or S Curve Accel/Decel	Standard
Jog at Preset Speed	Standard
Thread/Preset Speeds	7
Automatic Restart	Selectable
Coasting Motor Start	Standard
Coast or Ramp Stop Selection	Standard
Elapsed Time Meter	Optional
Standard Conditions for Application and Service	
Maximum Operating Ambient Temperature	0 – 50°C ②
Storage Temperature	-40 – 60°C
Humidity (Maximum), Non-condensing	95%
Altitude	100% load capacity (no derating) up to 3280 ft. (1000m); 1% derating for each 328 ft. (100m) above 3280 ft. (1000m); max. 9842 ft. (3000m)
Line Voltage Variation	+10/-15%
Line Frequency Variation	45 – 66 Hz
Efficiency	>96%
Power Factor (Displacement)	.99

② See **Table 40-321** for specific ratings.

Table 40-319. Standard I/O Specifications

Description	Specification
6 – Digital Input Programmable	24V: "0" ≤ 10V, "1" ≥ 18V, R_i > 5 kΩ
2 – Analog Input Configurable w/Jumpers	Voltage: 0 – ±10V, R_i > 200 kΩ Current: 0 (4) – 20 mA, R_i = 250 kΩ
2 – Digital Output Programmable	Form C Relays 250V AC 2 Amp or 30V DC2 Amp resistive
1 – Digital Output Programmable	Open collector 48V DC 50 mA
1 – Analog Output Programmable Configurable w/Jumper	0 – 20 mA, impedance 500 ohms, resolution 106 ±3%

Catalog Number Selection

Table 40-320. CFX9000 Enclosed Drive Catalog Numbering System

C F X 0 5 0 1 4 A A _ _ _ _ _ _ _ _ _ _

Build options alphabetically and numerically.

Product Family
CFX = Integrated Filter Clean Power Drive

Horsepower Rating		
007 = 7-1/2 hp	**040** = 40 hp	**150** = 150 hp
010 = 10 hp	**050** = 50 hp	**200** = 200 hp
015 = 15 hp	**060** = 60 hp	**250** = 250 hp
020 = 20 hp	**075** = 75 hp	**300** = 300 hp
025 = 25 hp	**100** = 100 hp	**350** = 350 hp
030 = 30 hp	**125** = 125 hp	**400** = 400 hp

Enclosure Rating
1 = UL Type 1
2 = UL Type 12
3 = UL Type 3R
6 = NEMA 12 Filtered

Voltage Rating
1 = 208V
2 = 230V
4 = 480V
5 = 575V (575 – 600V)

Application — Torque/Braking ①
A = I_L/No Brake Chopper
B = I_L/Internal Brake Chopper
D = I_H/No Brake Chopper
E = I_H/Internal Brake Chopper

Enclosed Style
A = Enclosed Drive

Enclosed Options ②③④		Type
K1	Door-Mounted Speed Potentiometer ⑤	Control
K2	Door-Mounted Speed Potentiometer with HOA Selector Switch ⑤	Control
K3	3 – 15 psig Follower	Control
K4	HAND/OFF/AUTO Switch (22 mm)	Control
K5	MANUAL/AUTO Reference Switch (22 mm)	Control
K6	START/STOP Pushbuttons (22 mm)	Control
KF	Bypass Test Switch for RA and RB	Addl. Bypass
KO	Standard Elapsed Time Meter	Control
L1	Power On and Fault Pilot Lights	Light
L2	Bypass Pilot Lights for RA, RB, Bypass Options	Addl. Bypass
LE	Red RUN Light	Light
P1	Input Disconnect	Input
P3	Input Line Fuses (200 kAIC)	Input
P7	Input Power Surge Protection	Input
P8	TVSS Transient Voltage Surge Suppressor	Input
PE	Output Contactor	Output
PF	Output Filter	Output
PG	MotoRx (Up to 600 Ft.) 1000 V/µS DV/DT Filter	Output
PH	Single Overload Relay	Output
PI	Dual Overload Relays	Output
PN	Dual Overloads for Bypass	Addl. Bypass
RA	Manual HOA Bypass Controller	Bypass
RB	Manual IOB Bypass Controller	Bypass
RC	Auto Transfer HOA Bypass Controller	Bypass
RD	Auto Transfer IOB Bypass Controller	Bypass
RG	Reduced Voltage Starter for Bypass	Bypass
S4	Floor Stand 6"	Enclosure
S5	Floor Stand 22"	Enclosure
S6	Floor Stand 12"	Enclosure
S9	Space Heater	Enclosure

Communication Options ⑥	
C2 = Modbus	**CA** = Johnson Controls N2
C3 = Profibus DP	**CI** = Modbus TCP
C4 = LonWorks	**CJ** = BACnet
C5 = Profibus DP (D9 Connector)	**CK** = Ethernet IP
C6 = CanOpen (Slave)	**D3** = RS-232 with D9 Connection
C7 = DeviceNet	
C8 = Modbus (D9 Type Connector)	

Control Options
B1 = 6 DI, 1 ext +24V DC/EXT +24V DC
B2 = 1 RO (NC/NO), 1 RO (NO), 1 Therm
B4 = 1 AI (mA isolated), 2 AO (mA isolated), 1 ext +24V DC/EXT +24V DC
B5 = 3 RO (NO)
B8 = 1 ext +24V DC/EXT +24V DC, 3 Pt100
B9 = 1 RO (NO), 5 DI 42 – 240V AC Input

Engineered Options	
HT	High Temperature rating for 50°C ⑦
VB	Varnished Boards

① Brake Chopper is standard in 208V, 230V and 480V drives up to FR6; optional in all other drives.
② Local/remote keypad is included as the standard Control Panel.
③ Some options are voltage and/or horsepower specific. Consult your Eaton representative for details.
④ See **Pages 40-224** and **40-225** for descriptions.
⑤ Includes local/remote speed reference switch.
⑥ See **Pages 40-226** and **40-227** for complete descriptions.
⑦ Consult Eaton for availability.

Product Selection



Figure 40-125. UL Type 12, 40 hp

When Ordering

- Select a Base Catalog Number that meets the application requirements — nominal horsepower, voltage and enclosure rating. (The enclosed drive's continuous output amp rating should be equal to or greater than the motor's full load amp rating.) The base enclosed package includes a standard drive, door-mounted alphanumeric panel and enclosure.
- The CFX9000 product uses the term High Overload (I_H) in place of the term Constant Torque (CT). Likewise, Low Overload (I_L) is used in place of the term Variable Torque (VT). The new terms are a more precise description of the rating. The older terms included ambient temperature ratings in addition to overload ratings. In order to minimize enclosure size and offer the highest ambient temperature rating, overload and temperature ratings are now treated separately. Ambient temperature ratings are shown in **Table 40-321**.

Table 40-321. Ambient Temperature Ratings

Enclosure Size	I_H	I_L
B, C, 9 ①	40°C	40°C
7, 8	50°C	50°C

① For high temperature rating, select HT option code and consult factory for pricing.

- If Dynamic Brake Chopper or Control/Communication option is desired, change the appropriate code in the Base Catalog Number.
- **Note:** All of the programming is exactly the same as the standard SVX9000 drive.
- Select Enclosed Options. Add the codes as suffixes to the Base Catalog Number in alphabetical and numeric order.

Table 40-322. 208V — UL Type 1, UL Type 12, UL Type 3R and NEMA 12 Filtered Product Selection

hp	NEC Current (A)	Chassis Frame	UL Type 1		UL Type 12 and NEMA 12 Filtered		UL Type 3R	
			Base Catalog Number	Price U.S. $	Base Catalog Number	Price U.S. $	Base Catalog Number	Price U.S. $
Low Overload Drive								
7-1/2	24.2	FR5	①		**CFX00721BA**		**CFX00731BA**	
10	30.8	FR5	①		**CFX01021BA**		**CFX01031BA**	
15	46.2	FR6	①		**CFX01521BA**		**CFX01531BA**	
20	59.4	FR6	①		**CFX02021BA**		**CFX02031BA**	
25	74.8	FR7	①		**CFX02521AA**		**CFX02531AA**	
30	88	FR7	①		**CFX03021AA**		**CFX03031AA**	
40	114	FR7	①		**CFX04021AA**		**CFX04031AA**	
50	143	FR8	**CFX05011AA**		**CFX05061AA**		**CFX05031AA**	
60	169	FR8	**CFX06011AA**		**CFX06061AA**		**CFX06031AA**	
75	211	FR8	**CFX07511AA**		**CFX07561AA**		**CFX07531AA**	
100	273	FR9	**CFX10011AA**		**CFX10061AA**		**CFX10031AA**	
High Overload Drive								
7-1/2	24.2	FR5	①		**CFX00721EA**		**CFX00731EA**	
10	30.8	FR6	①		**CFX01021EA**		**CFX01031EA**	
15	46.2	FR6	①		**CFX01521EA**		**CFX01531EA**	
20	59.4	FR7	①		**CFX02021DA**		**CFX02031DA**	
25	74.8	FR7	①		**CFX02521DA**		**CFX02531DA**	
30	88	FR7	①		**CFX03021DA**		**CFX03031DA**	
40	114	FR8	**CFX04011DA**		**CFX04061DA**		**CFX04031DA**	
50	143	FR8	**CFX05011DA**		**CFX05061DA**		**CFX05031DA**	
60	169	FR8	**CFX06011DA**		**CFX06061DA**		**CFX06031DA**	
75	211	FR9	**CFX07511DA**		**CFX07561DA**		**CFX07531DA**	
100	273	FR9	**CFX10011DA**		**CFX10061DA**		**CFX10031DA**	

① FR5 – FR7 drives not available in UL Type 1.

Table 40-323. CFX9000 Enclosure Selection

Chassis Frame	UL Type 1		UL Type 12		UL Type 3R	
	Disconnect Only	With Power Options	Disconnect Only	With Power Options	Disconnect Only	With Power Options
FR4	N/A		B		B	C
FR5	N/A		B	C	B	C
FR6	N/A		B	C	B	C
FR7	N/A	7	C	7	C	E
FR8	7				E	
FR9	8				E	

Table 40-324. Enclosure Dimension Drawings

Enclosure Size	UL Type 1 & UL Type 12 Drawings	UL Type 3R Drawings
B	**Page 40-231**	**Page 40-233**
C	**Page 40-232**	**Page 40-234**
E	N/A	**Page 40-235**
7	**Page 40-236**	②
8	**Page 40-237**	②
9	**Page 40-238**	②

② Not available for UL Type 3R.

Note: Enclosures 7 and 8 are NEMA 12 Filtered.

Discount Symbol **SS-3**

Table 40-325. 230V — UL Type 1, UL Type 12, UL Type 3R and NEMA 12 Filtered Product Selection

hp	NEC Current (A)	Chassis Frame	UL Type 1		UL Type 12 and NEMA 12 Filtered		UL Type 3R	
			Base Catalog Number	Price U.S. $	Base Catalog Number	Price U.S. $	Base Catalog Number	Price U.S. $
Low Overload Drive								
7-1/2	22	FR5	①		**CFX00722BA**		**CFX00732BA**	
10	28	FR5	①		**CFX01022BA**		**CFX01032BA**	
15	42	FR6	①		**CFX01522BA**		**CFX01532BA**	
20	54	FR6	①		**CFX02022BA**		**CFX02032BA**	
25	68	FR7	①		**CFX02522AA**		**CFX02532AA**	
30	80	FR7	①		**CFX03022AA**		**CFX03032AA**	
40	104	FR7	①		**CFX04022AA**		**CFX04032AA**	
50	130	FR8	**CFX05012AA**		**CFX05062AA**		**CFX05032AA**	
60	154	FR8	**CFX06012AA**		**CFX06062AA**		**CFX06032AA**	
75	192	FR8	**CFX07512AA**		**CFX07562AA**		**CFX07532AA**	
100	248	FR9	**CFX10012AA**		**CFX10062AA**		**CFX10032AA**	
High Overload Drive								
7-1/2	22	FR5	①		**CFX00722EA**		**CFX00732EA**	
10	28	FR6	①		**CFX01022EA**		**CFX01032EA**	
15	42	FR6	①		**CFX01522EA**		**CFX01532EA**	
20	54	FR7	①		**CFX02022DA**		**CFX02032DA**	
25	68	FR7	①		**CFX02522DA**		**CFX02532DA**	
30	80	FR7	①		**CFX03022DA**		**CFX03032DA**	
40	104	FR8	**CFX04012DA**		**CFX04062DA**		**CFX04032DA**	
50	130	FR8	**CFX05012DA**		**CFX05062DA**		**CFX05032DA**	
60	154	FR8	**CFX06012DA**		**CFX06062DA**		**CFX06032DA**	
75	192	FR9	**CFX07512DA**		**CFX07562DA**		**CFX07532DA**	
100	248	FR9	**CFX10012DA**		**CFX10062DA**		**CFX10032DA**	

① FR5 – FR7 drives not available in UL Type 1.

Table 40-326. CFX9000 Enclosure Selection

Chassis Frame	UL Type 1		UL Type 12		UL Type 3R	
	Disconnect Only	With Power Options	Disconnect Only	With Power Options	Disconnect Only	With Power Options
FR4	N/A		B		B	C
FR5	N/A		B	C	B	C
FR6	N/A		B	C	B	C
FR7	N/A	7	C	7	C	E
FR8	7				E	
FR9	8				E	

Table 40-327. Enclosure Dimension Drawings

Enclosure Size	UL Type 1 & UL Type 12 Drawings	UL Type 3R Drawings
B	**Page 40-231**	**Page 40-233**
C	**Page 40-232**	**Page 40-234**
E	N/A	**Page 40-235**
7	**Page 40-236**	②
8	**Page 40-237**	②
9	**Page 40-238**	②

② Not available for UL Type 3R.

Note: Enclosures 7 and 8 are NEMA 12 Filtered.

Enclosed Drives

Table 40-328. 480V AC CFX9000 Base Drive Product Selection

hp	NEC Current (A)	Chassis Frame	UL Type 1 Base Catalog Number ①	UL Type 1 Price U.S. $	UL Type 12 and NEMA 12 Filtered Base Catalog Number ①	UL Type 12 and NEMA 12 Filtered Price U.S. $	UL Type 3R Base Catalog Number ①	UL Type 3R Price U.S. $
Low Overload Drive								
7-1/2	11	FR4	③		**CFX00724BA**		**CFX00734BA**	
10	14	FR5	③		**CFX01024BA**		**CFX01034BA**	
15	21	FR5	③		**CFX01524BA**		**CFX01534BA**	
20	27	FR5	③		**CFX02024BA**		**CFX02034BA**	
25	34	FR6	③		**CFX02524BA**		**CFX02534BA**	
30	40	FR6	③		**CFX03024BA**		**CFX03034BA**	
40	52	FR6	③		**CFX04024BA**		**CFX04034BA**	
50	65	FR7	**CFX05014AA** ④		**CFX05024AA**		**CFX05034AA**	
60	77	FR7	**CFX06014AA** ④		**CFX06024AA**		**CFX06034AA**	
75	96	FR7	**CFX07514AA** ④		**CFX07524AA**		**CFX07534AA**	
100	124	FR8	**CFX10014AA**		**CFX10064AA**		**CFX10034AA**	
125	156	FR8	**CFX12514AA**		**CFX12564AA**		**CFX12534AA**	
150	180	FR8	**CFX15014AA**		**CFX15064AA**		**CFX15034AA**	
200	240	FR9	**CFX20014AA**		**CFX20064AA**		**CFX20034AA**	
250	302	FR9	**CFX25014AA**		**CFX25064AA**		**CFX25034AA**	
300	361	FR10	**CFX30014AA**		**CFX30064AA**		②	
350	414	FR10	**CFX35014AA**		**CFX35064AA**		②	
400	477	FR10	**CFX40014AA**		**CFX40064AA**		②	
High Overload Drive								
7-1/2	11	FR5	③		**CFX00724EA**		**CFX00734EA**	
10	14	FR5	③		**CFX01024EA**		**CFX01034EA**	
15	21	FR5	③		**CFX01524EA**		**CFX01534EA**	
20	27	FR6	③		**CFX02024EA**		**CFX02034EA**	
25	34	FR6	③		**CFX02524EA**		**CFX02534EA**	
30	40	FR6	③		**CFX03024EA**		**CFX03034EA**	
40	52	FR7	**CFX04014DA** ④		**CFX04024DA**		**CFX04034DA**	
50	65	FR7	**CFX05014DA** ④		**CFX05024DA**		**CFX05034DA**	
60	77	FR7	**CFX06014DA** ④		**CFX06024DA**		**CFX06034DA**	
75	96	FR8	**CFX07514DA**		**CFX07564DA**		**CFX07534DA**	
100	124	FR8	**CFX10014DA**		**CFX10064DA**		**CFX10034DA**	
125	156	FR8	**CFX12514DA**		**CFX12564DA**		**CFX12534DA**	
150	180	FR9	**CFX15014DA**		**CFX15064DA**		**CFX15034DA**	
200	240	FR9	**CFX20014DA**		**CFX20064DA**		**CFX20034DA**	
250	302	FR10	**CFX25014DA**		**CFX25064DA**		②	
300	361	FR10	**CFX30014DA**		**CFX30064DA**		②	
350	414	FR10	**CFX35014DA**		**CFX35064DA**		②	

① The Integrated Filter Clean Power assembly includes a standard drive, door-mounted local/remote keypad and enclosure.
② Consult factory.
③ FR4 – FR6 drives not available in UL Type 1.
④ This catalog number is used only with power options.

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Table 40-329. CFX9000 Enclosure Selection

Chassis Frame	UL Type 1 Disconnect Only	UL Type 1 With Power Options	UL Type 12 Disconnect Only	UL Type 12 With Power Options	UL Type 3R Disconnect Only	UL Type 3R With Power Options
FR4	N/A		B		B	C
FR5	N/A		B	C	B	C
FR6	N/A		B	C	B	C
FR7	N/A	7	C	7	C	E
FR8	7				E	
FR9	8				E	
FR10	9				⑤	

⑤ Consult factory.

Table 40-330. Enclosure Dimension Drawings

Enclosure Size	UL Type 1 & UL Type 12 Drawings	UL Type 3R Drawings
B	**Page 40-231**	**Page 40-233**
C	**Page 40-232**	**Page 40-234**
E	N/A	**Page 40-235**
7	**Page 40-236**	⑥
8	**Page 40-237**	⑥
9	**Page 40-238**	⑥

⑥ Not available for UL Type 3R.

Note: Enclosures 7 and 8 are NEMA 12 Filtered.

Discount Symbol **SS-3**

Table 40-331. 575V — UL Type 1, UL Type 12, UL Type 3R and NEMA 12 Filtered Product Selection

hp	NEC Current (A)	Chassis Frame	UL Type 1		UL Type 12 and NEMA 12 Filtered		UL Type 3R	
			Base Catalog Number	Price U.S. $	Base Catalog Number	Price U.S. $	Base Catalog Number	Price U.S. $
Low Overload Drive								
15	17	FR6	①		**CFX01525AA**		**CFX01535AA**	
20	22	FR6	①		**CFX02025AA**		**CFX02035AA**	
25	27	FR6	①		**CFX02525AA**		**CFX02535AA**	
30	32	FR6	①		**CFX03025AA**		**CFX03035AA**	
40	41	FR7	①		**CFX04025AA**		**CFX04035AA**	
50	52	FR7	①		**CFX05025AA**		**CFX05035AA**	
60	62	FR8	**CFX06015AA**		**CFX06065AA**		**CFX06035AA**	
75	77	FR8	**CFX07515AA**		**CFX07565AA**		**CFX07535AA**	
100	99	FR8	**CFX10015AA**		**CFX10065AA**		**CFX10035AA**	
125	125	FR9	**CFX12515AA**		**CFX12565AA**		**CFX12535AA**	
150	144	FR9	**CFX15015AA**		**CFX15065AA**		**CFX15035AA**	
200	192	FR9	**CFX20015AA**		**CFX20065AA**		**CFX20035AA**	
250	242	FR10	**CFX25015AA**		**CFX25065AA**		②	
300	289	FR10	**CFX30015AA**		**CFX30065AA**		②	
400	382	FR10	**CFX40015AA**		**CFX40065AA**		②	
High Overload Drive								
10	14	FR6	①		**CFX01025DA**		**CFX01035DA**	
15	17	FR6	①		**CFX01525DA**		**CFX01535DA**	
20	22	FR6	①		**CFX02025DA**		**CFX02035DA**	
25	27	FR6	①		**CFX02525DA**		**CFX02535DA**	
30	32	FR7	①		**CFX03025DA**		**CFX03035DA**	
40	41	FR7	①		**CFX04025DA**		**CFX04035DA**	
50	52	FR8	**CFX05015DA**		**CFX05065DA**		**CFX05035DA**	
60	62	FR8	**CFX06015DA**		**CFX06065DA**		**CFX06035DA**	
75	77	FR8	**CFX07515DA**		**CFX07565DA**		**CFX07535DA**	
100	99	FR9	**CFX10015DA**		**CFX10065DA**		**CFX10035DA**	
125	125	FR9	**CFX12515DA**		**CFX12565DA**		**CFX12535DA**	
150	144	FR9	**CFX15015DA**		**CFX15065DA**		**CFX15035DA**	
200	192	FR10	**CFX20015DA**		**CFX20065DA**		②	
250	242	FR10	**CFX25015DA**		**CFX25065DA**		②	
300	289	FR10	**CFX30015DA**		**CFX30065DA**		②	

① FR6 – FR7 drives not available in UL Type 1.
② Consult factory.

Table 40-332. CFX9000 Enclosure Selection

Chassis Frame	UL Type 1		UL Type 12		UL Type 3R	
	Disconnect Only	With Power Options	Disconnect Only	With Power Options	Disconnect Only	With Power Options
FR4	N/A		B		B	C
FR5	N/A		B	C	B	C
FR6	N/A		B	C	B	C
FR7	N/A	7	C	7	C	E
FR8	7				E	
FR9	8				E	
FR10	9				③	

③ Consult factory.

Table 40-333. Enclosure Dimension Drawings

Enclosure Size	UL Type 1 & UL Type 12 Drawings	UL Type 3R Drawings
B	**Page 40-231**	**Page 40-233**
C	**Page 40-232**	**Page 40-234**
E	N/A	**Page 40-235**
7	**Page 40-236**	④
8	**Page 40-237**	④
9	**Page 40-238**	④

④ Not available for UL Type 3R.

Note: Enclosures 7 and 8 are NEMA 12 Filtered.

Discount Symbol **SS-3**

Options

Control/Communication Option Descriptions

Table 40-334. Available Control/Communications Options

Option	Description	Option Type
K1	**Door-Mounted Speed Potentiometer** — Provides the DRIVE with the ability to adjust the frequency reference using a door-mounted potentiometer. This option uses the 10V DC reference to generate a 0 – 10V signal at the analog voltage input signal terminal. When the HOA bypass option is added, the speed is controlled when the HOA switch is in the hand position. Without the HOA bypass option, a 2-position switch (labeled local/remote) is provided on the keypad to select speed reference from the Speed Potentiometer or a remote speed signal.	Control
K2	**Door-Mounted Speed Potentiometer with HOA Selector Switch** — Provides the DRIVE with the ability to start/stop and adjust the speed reference from door-mounted control devices or remotely from customer supplied inputs. In HAND position, the drive will start and the speed is controlled by the door-mounted speed potentiometer. The drive will be disabled in the OFF position. When AUTO is selected, the drive run and speed control commands are via user-supplied dry contact and 4 – 20 mA signal.	Control
K3	**3 – 15 psig Follower** — Provides a pneumatic transducer which converts a 3 – 15 psig pneumatic signal to either 0 – 8V DC or a 1 – 9V DC signal interface with the DRIVE. The circuit board is mounted on the inside of the front enclosure panel and connects to the user's pneumatic control system via 6 ft. (1.8m) of flexible tubing and a 1/4 inch (6.4 mm) brass tube union.	Control
K4	**HAND/OFF/AUTO Switch for Non-bypass Configurations** — Provides a three-position selector switch that allows the user to select either a Hand or Auto mode of operation. Hand mode is defaulted to keypad operation, and Auto mode is defaulted to control from an external terminal source. These modes of operation can be configured via drive programming to allow for alternate combinations of start and speed sources. Start and speed sources include Keypad, I/O and Fieldbus.	Control
K5	**MANUAL/AUTO Speed Reference Switch** — Provides door-mounted selector switch for Manual/Auto speed reference.	Control
K6	**START/STOP Pushbuttons** — Provides door-mounted START and STOP pushbuttons for either bypass or non-bypass configurations.	Control
KF	**Bypass Test Switch for RB and RA** — Allows the user to energize the AF drive for testing while operating the motor on the bypass controller. The Test Switch is mounted on the inside of the enclosure door.	Addl. Bypass
KO	**Standard Elapsed Time Meter** — Provides a door-mounted elapsed run time meter.	Control
L1	**Power On and Fault Power Lights** — Provides a white power on light that indicates power to the enclosed cabinet and a red fault light that indicates a drive fault has occurred.	Light
L2	**Bypass Pilot Lights for RB, RA Bypass Options** — A green light indicates when the motor is running in inverter mode and an amber light indicates when the motor is running in bypass mode. The lights are mounted on the enclosure door, above the switches.	Addl. Bypass
LE	**Red Run Pilot Light (22 mm)** — Provides a red run pilot light that indicates the drive is running.	Light
P1	**Input Disconnect Assembly Rated to 100 kAIC** — High Interrupting Motor Circuit Protector (HMCP) or Circuit Breaker that provides a means of short circuit protection for the power cables between it and the DRIVE, and protection from high-level ground faults on the power cable. Allows a convenient means of disconnecting the DRIVE from the line and the operating mechanism can be padlocked in the OFF position. This is factory mounted in the enclosure.	Input
P3	**Input Line Fuses Rated to 200 kAIC** — Provides high-level fault protection of the DRIVE input power circuit from the load side of the fuses to the input side of the power transistors. This option consists of three 200 kA fuses, which are factory mounted in the enclosure.	Input
P7	**MOV Surge Suppressor** — Provides a Metal Oxide Varistor (MOV) connected to the line side terminals and is designed to clip line side transients.	Input
P8	**TVSS Transient Voltage Surge Suppressor** — Provides transient voltage surge suppression of the unit. Consult factory for ratings.	Input
PE	**Output Contactor** — Provides a means for positive disconnection of the drive output from the motor terminals. The contactor coil is controlled by the drive's run or permissive logic. NC and NO auxiliary contacts rated at 10A, 600V AC are provided for customer use. Bypass Options **RB** and **RA** include an Output Contactor as standard. This option includes a low VA 115V AC fused Control Power Transformer and is factory mounted in the enclosure.	Output
PF	**Output Filter** — Used to reduce the transient voltage (DV/DT) at the motor terminals. The Output Filter is recommended for cable lengths exceeding 100 ft. (30m) or for a drive rated at 525 – 690V. This option is mounted in the enclosure, and may be used in conjunction with a Brake Chopper Circuit.	Output
PG	**MotoRx (300 – 600 Ft.) 1000 V/µS DV/DT Filter** — Used to reduce transient voltage (DV/DT) and peak voltages at the motor terminals. This option is comprised of a .5% line reactor, followed by capacitive filtering and an energy recovery/clamping circuit. Unlike the Output Filter (See option **PF**), the MotoRx recovers most of the energy from the voltage peaks, resulting in a lower voltage drop to the motor, and therefore conserving power. This option is used when the distance between a single motor and the drive is 300 – 600 feet (91 – 183m). *This option can not be used with the Brake Chopper Circuit. The Output Filter (option* ***PF****) should be investigated as an alternative.*	Output
PH	**Single Overload Relay** — Uses a bimetallic overload relay to provide additional overload current protection to the motor on configurations without bypass options. It is included with the Bypass Configurations for overload current protection in the bypass mode. The Overload Relay is mounted within the enclosure, and is manually resettable. Heater pack included.	Output
PI	**Dual Overload Relays** — This option is recommended when a single drive is operating 2 motors and overload current protection is needed for each of the motors. The standard configuration includes two bimetallic overload relays, each sized to protect a motor with 50% of the drive hp rating. For example, a 100 hp drive would include two overload relays sized to protect two 50 hp motors. The relays are mounted within the enclosure, and are manually resettable. Heater packs not included.	Output
PN	**Dual Overloads for Bypass** — This option is recommended when a single drive is operating 2 motors in the bypass mode and overload current protection is needed for each of the motors. The standard configuration includes two bimetallic overload relays, each sized to protect a motor with 50% of the drive hp rating. For example, a 100 hp drive would include two overload relays sized to protect two 50 hp motors. The relays are mounted within the enclosure, and are manually resettable.	Addl. Bypass

Table 40-334. Available Control/Communications Options (Continued)

Option	Description	Option Type
RA	**Manual HOA Bypass Controller** — The Manual HAND/OFF/AUTO (HOA) — 3-contactor — bypass option provides a means of bypassing the DRIVE, allowing the AC motor to be operated at full speed directly from the AC supply line. This option consists of an input disconnect, a fused control power transformer, and a full voltage bypass starter with a door mounted HOA selector switch and an INVERTER/BYPASS switch. The HOA switch provides the ability to start and stop the drive in the inverter mode. For applications up to 250 hp, an ***IT.*** Series IEC input contactor, an ***IT.*** Series IEC output contactor, and an ***IT.*** Series IEC starter with an electronic overload relay is included. For applications above 250 hp, an Advantage input contactor, an Advantage output contactor and an Advantage starter with electronic overload protection is included. The contactors are mechanically and electrically interlocked (see power diagram on **Page 40-239**).	Bypass
RB	**Manual IOB Bypass Controller** — The Manual INVERTER/OFF/BYPASS (IOB) — 3-contactor — bypass option provides a means of bypassing the DRIVE, allowing the AC motor to be operated at full speed directly from the AC supply line. This option consists of an input disconnect, a fused control power transformer, and a full voltage bypass starter with a door mounted IOB selector switch. For applications up to 250 hp, an ***IT.*** Series IEC input contactor, an ***IT.*** Series IEC output contactor, and an ***IT.*** Series IEC starter with an electronic overload relay is included. For applications above 250 hp, an Advantage input contactor, an Advantage output contactor and an Advantage starter with electronic overload protection is included. The contactors are mechanically and electrically interlocked (see power diagram on **Page 40-239**).	Bypass
RC	**Auto Transfer HOA Bypass Controller** – The Manual HAND/OFF/AUTO (HOA) — 3-contactor — bypass option provides a means of bypassing the DRIVE, allowing the AC motor to be operated at full speed directly from the AC supply line. The circuitry provides an automatic transfer of the load to “across the line” operation after a drive trip. This option consists of an input disconnect, a fused control power transformer, and a full voltage bypass starter with a door mounted HOA selector switch and an INVERTER/BYPASS switch. The HOA switch provides the ability to start and stop the drive in either mode. For applications up to 250 hp, an ***IT.*** Series IEC input contactor, an ***IT.*** Series IEC output contactor, and an ***IT.*** Series IEC starter with an electronic overload relay is included. For applications above 250 hp, an Advantage input contactor, an Advantage output contactor and an Advantage starter with electronic overload protection is included. The contactors are mechanically and electrically interlocked (see power diagram on **Page 40-239**). Door mounted pilot lights are provided which indicate bypass or inverter operation. A green light indicates when the motor is running in inverter mode and an amber light indicates when the motor is running in bypass mode. **WARNING**: The motor may restart when the overcurrent relay is reset when operating in bypass, unless the IOB selector switch is turned to the OFF position.	Bypass
RD	**Auto Transfer IOB Bypass Controller** — The Auto INVERTER/OFF/BYPASS (IOB) — 3-contactor — bypass option provides a means of bypassing the DRIVE, allowing the AC motor to be operated at full speed directly from the AC supply line. The circuitry provides an automatic transfer of the load to “across the line” operation after a drive trip. This option consists of an input disconnect, a fused control power transformer, and a full voltage bypass starter with a door mounted IOB selector switch. For applications up to 250 hp, an ***IT.*** Series IEC input contactor, an ***IT.*** Series IEC output contactor, and an ***IT.*** Series IEC starter with an electronic overload relay is included. For applications above 250 hp, an Advantage input contactor, an Advantage output contactor and an Advantage starter with electronic overload protection is included. The contactors are mechanically and electrically interlocked (see power diagram on **Page 40-239**). Door mounted pilot lights are provided which indicate bypass or inverter operation. A green light indicates when the motor is running in inverter mode and an amber light indicates when the motor is running in bypass mode. **WARNING**: The motor may restart when the overcurrent relay is reset when operating in bypass, unless the IOB selector switch is turned to the OFF position.	Bypass
RG	**Reduced Voltage Starter for Bypass** — Used in conjunction with bypass option RA, RB, RC or RD. This option adds ***IT.*** Series reduced voltage soft starter to bypass assembly for soft starting in bypass mode.	Bypass
S4	**Floor Stand 6"** — Raises “E” box off the ground 6" (152.4 mm). Recommended when box is not installed on an appropriate concrete pad.	Enclosure
S5	**Floor Stand 22"** — Converts a Size B or C, normally wall mounted enclosure to a floor standing enclosure with a height of 22" (558.8 mm).	Enclosure
S6	**Floor Stand 12"** — Converts a Size C, normally wall mounted enclosure to a floor standing enclosure with a height of 12" (304.8 mm).	Enclosure
S9	**Space Heater** — Prevents condensation from forming in the enclosure when the drive is inactive or in storage. Includes a thermostat for variable temperature control. Heater requires a customer supplied 115V remote supply source.	Enclosure

CFX9000 Series Option Board Kits

The 9000X Series drives can accommodate a wide selection of expander and adapter option boards to customize the drive for your application needs. The drive's control unit is designed to accept a total of five option boards (see **Figure 40-126**).

The 9000X Series factory installed standard board configuration includes an A9 I/O board and an A2 relay output board, which are installed in slots A and B.

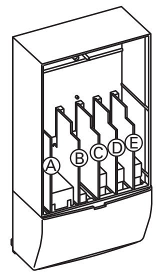


Figure 40-126. 9000X Series Option Boards

Table 40-335. Option Board Kits

Option Kit Description ②	Allowed Slot Locations ①	Field Installed		Factory Installed		SVX Ready Programs						
		Catalog Number	Price U.S.$	Option Designator	Adder U.S.$	Basic	Local/ Remote	Standard	MSS	PID	Multi-P.	PFC
Standard I/O Cards (See Figure 40-126)												
2 RO (NC/NO)	B	**OPTA2**		**—**		X	X	X	X	X	X	X
6 DI, 1 DO, 2 AI, 1AO, 1 +10V DC ref, 2 ext +24V DC/ EXT +24V DC	A	**OPTA9**		**—**		X	X	X	X	X	X	X
Extended I/O Card Options												
6 DI, 1 ext +24V DC/EXT +24V DC	B, C, **D**, E	**OPTB1**		**B1**		—	—	—	—	—	X	X
1 RO (NC/NO), 1 RO (NO), 1 Therm	B, C, **D**, E	**OPTB2**		**B2**		—	—	—	—	—	X	X
1 AI (mA isolated), 2 AO (mA isolated), 1 ext +24V DC/EXT +24V DC	B, C, **D**, E	**OPTB4**		**B4**		X	X	X	X	X	X	X
3 RO (NO)	B, C, **D**, E	**OPTB5**		**B5**		—	—	—	—	—	X	X
1 ext +24V DC/EXT +24V DC, 3 Pt100	B, C, **D**, E	**OPTB8**		**B8**		—	—	—	—	—	—	—
1 RO (NO), 5 DI 42 – 240V AC Input	B,C, **D**, E	**OPTB9**		**B9**		—	—	—	—	—	X	X
Communication Cards ③												
Modbus	D, **E**	**OPTC2**		**C2**		X	X	X	X	X	X	X
Johnson Controls N2	D, **E**	**OPTC2**		**CA**		—	—	—	—	—	—	—
Profibus DP	D, **E**	**OPTC3**		**C3**		X	X	X	X	X	X	X
LonWorks	D, **E**	**OPTC4**		**C4**		X	X	X	X	X	X	X
Profibus DP (D9 Connector)	D, **E**	**OPTC5**		**C5**		X	X	X	X	X	X	X
CanOpen (Slave)	D, **E**	**OPTC6**		**C6**		X	X	X	X	X	X	X
DeviceNet	D, **E**	**OPTC7**		**C7**		X	X	X	X	X	X	X
Modbus (D9 Type Connector)	D, **E**	**OPTC8**		**C8**		X	X	X	X	X	X	X
Modbus TCP	D, **E**	**OPTCI**		**CI**		X	X	X	X	X	X	X
BACnet	D, **E**	**OPTCJ**		**CJ**		X	X	X	X	X	X	X
Ethernet IP	D, **E**	**OPTCK**		**CK**		X	X	X	X	X	X	X
RS-232 with D9 Connection	D, **E**	**OPTD3**		**D3**		X	X	X	X	X	X	X

① Option card must be installed in one of the slots listed for that card. Slot indicated in Bold is the preferred location.
② AI = Analog Input; AO = Analog Output, DI = Digital Input, DO = Digital Output, RO = Relay Output
③ OPTC2 is a multi-protocol option card.

Modbus RTU Network Communications

The Modbus Network Card OPTC2 is used for connecting the 9000X Drive as a slave on a Modbus network. The interface is connected by a 9-pin DSUB connector (female) and the baud rate ranges from 300 to 19200 baud. Other communication parameters include an address range from 1 to 247; a parity of None, Odd or Even; and the stop bit is 1.

Profibus Network Communications

The Profibus Network Card OPTC3 is used for connecting the 9000X Drive as a slave on a Profibus-DP network. The interface is connected by a 9-pin DSUB connector (female). The baud rates range from 9.6K baud to 12M baud, and the addresses range from 1 to 127.

LonWorks Network Communications

The LonWorks Network Card OPTC4 is used for connecting the 9000X Drive on a LonWorks network. This interface uses Standard Network Variable Types (SNVT) as data types. The channel connection is achieved using a FTT-10A Free Topology transceiver via a single twisted transfer cable. The communication speed with LonWorks is 78 kBits/s.

Discount Symbol **SS-3**

CanOpen (Slave) Communications

The CanOpen (Slave) Network Card OPTC6 is used for connecting the 9000X Drive to a host system. According to ISO11898 standard cables to be chosen for CAN bus should have a nominal impedance of 120Ω, and specific line delay of nominal 5 nS/m. 120Ω line termination resistors required for installation.

DeviceNet Network Communications

The DeviceNet Network Card OPTC7 is used for connecting the 9000X Drive on a DeviceNet Network. It includes a 5.08 mm pluggable connector. Transfer method is via CAN using a 2-wire twisted shielded cable with 2-wire bus power cable and drain. The baud rates used for communication include 125K baud, 250K baud and 500K baud.

Johnson Controls Metasys™ N2 Network Communications

The OPTC2 fieldbus board provides communication between the 9000X Drive and a Johnson Controls Metasys™ N2 network. With this connection, the drive can be controlled, monitored and programmed from the Metasys system. The N2 fieldbus is available as a factory installed option and as a field installable kit.

Modbus/TCP Network Communications

The Modbus/TCP Network Card OPTCI is used for connecting the 9000X Drive to Ethernet networks utilizing Modbus protocol. It includes an RJ-45 pluggable connector. This interface provides a selection of standard and custom register values to communicate drive parameters. The board supports 10 Mbps and 100 Mbps communication speeds. The IP address of the board is configurable over Ethernet using a supplied software tool.

BACnet Network Communications

The BACnet Network Card OPTCJ is used for connecting the 9000X Drive to BACnet networks. It includes a 5.08 mm pluggable connector. Data transfer is Master-Slave/Token Passing (MS/TP) RS-485. This interface uses a collection of 30 Binary Value Objects (BVOs) and 35 Analog Value Objects (AVOs) to communicate drive parameters. The card supports 9.6, 19.2 and 38.4 Kbaud communication speeds and supports network addresses 1 – 127.

Ethernet/IP Network Communications

The Ethernet/IP Network Card OPTCK is used for connecting the 9000X Drive to Ethernet/Industrial Protocol networks. It includes an RJ-45 pluggable connector. The interface uses CIP objects to communicate drive parameters (CIP is “Common Industrial Protocol”, the same protocol used by DeviceNet). The board supports 10 Mbps and 100 Mbps communication speeds. The IP address of the board is configurable by Static, BOOTP and DHCP methods.

Table 40-336. I/O Specifications for the Control/Communication Options

Description	Specifications
Analog voltage, input	0 – ±10V, R_i ≥ 200 kΩ
Analog current, input	0 (4) – 20 mA, R_i = 250Ω
Digital Input	24V: “0” ≤ 10V, “1” ≥ 18V, R_i > 5 kΩ
Aux. voltage	24V (±20%), max. 50 mA
Reference voltage	10V ±3%, max. 10 mA
Analog current, output Analog voltage, output	0 (4) – 20 mA, R_L = 500 kΩ, resolution 10 bit, accuracy ≤ ±2% 0 (2) – 10V, R_L ≥ 1 kΩ, resolution 10 bit, accuracy ≤ ±2%
Relay output Max. switching voltage Max. switching load Max. continuous load	 300V DC, 250V AC 8A/24V DC, .4A/300V DC, 2 kVA/250V AC 2A rms
Thermistor input	R_{trip} = 4.7 kΩ

Table 40-337. Conformal (Varnished) Coating Adder — VB Option 208V, 230V, 480V and 575V ①

Chassis Frame	Delivery Code	Adder U.S. $	Chassis Frame	Delivery Code	Adder U.S. $
FR6 FR7 FR8	FP FP FP		FR9 FR10	FP FP	

① See catalog number description to order.

Enclosed Options

Table 40-338. 208V and 230V Light Options

Catalog Number Suffix ➡	Power On/Fault Pilot Lights (22 mm)	Red RUN Light (22 mm)
	L1	LE
hp	Adder U.S. $	Adder U.S. $
7-1/2 – 100		

Table 40-339. 208V and 230V Control Options

Catalog Number Suffix ➡	Door-Mounted Speed Potentiometer	Door-Mounted Speed Potentiometer with HOA Selector Switch	3 – 15 psig Follower	HAND/OFF/AUTO Switch (22 mm)	MANUAL/AUTO Ref Switch (22 mm)	START/STOP Pushbuttons (22 mm)	Standard Elapsed Time Meter	Input Power Surge Protection MOV	TVSS Transient Voltage Surge Suppressor
	K1	K2	K3	K4	K5	K6	KO	P7	P8
hp	Adder U.S. $	Adder U.S. $	Adder U.S. $	Adder U.S. $	Adder U.S. $	Adder U.S. $	Adder U.S. $	Adder U.S. $	Adder U.S. $
7-1/2 – 100									

Discount Symbol SS-3

40

Table 40-340. 208V and 230V Bypass Options ①

Catalog Number Suffix	Bypass Test Switch for RA, RB, RC, RD	Bypass Pilot Lights for RA, RB Options	Dual Overloads for Bypass	Manual HOA Bypass Controller	Manual IOB Bypass Controller	Auto Transfer HOA Bypass Controller	Auto Transfer IOB Bypass Controller	Reduced Volt Starter for Bypass
	KF	L2	PN	RA	RB	RC	RD	RG
hp	Adder U.S. $	Adder U.S. $	Adder U.S. $	Adder U.S. $	Adder U.S. $	Adder U.S. $	Adder U.S. $	Adder U.S. $
7-1/2 10 15 20								
25 30 40 50								
60 75 100								

① See **Pages 40-224** and **40-225** for details.

Table 40-341. 208V and 230V Enclosure Options

Catalog Number Suffix	Floor Stand 6" (152.4 mm)	Floor Stand 22" (558.8 mm)	Floor Stand 12" (304.8 mm)	Space Heater ②
	S4	S5	S6	S9
Enclosure Size	Adder U.S. $	Adder U.S. $	Adder U.S. $	Adder U.S. $
7 8 9				
B				
C				
E				

② Requires customer supplied 115V AC supply.

Table 40-342. 208V and 230V Power Options

Catalog Number Suffix	Input		Output		
	Input Disconnect (HMCP) 65 kAIC	Input Line Fuses 200 kAIC	Output Contactor	Single Overload Relay ③	Dual Overload Relays ③
	P1	P3	PE	PH	PI
hp	Adder U.S. $	Adder U.S. $	Adder U.S. $	Adder U.S. $	Adder U.S. $
7-1/2 10 15 20					
25 30 40 50					
60 75 100					

③ Heater packs not included.

Discount Symbol **SS-3**

Table 40-343. 480V and 575V Light Options

Catalog Number Suffix ➡	Power On/Fault Pilot Lights (22 mm)	Red RUN Light (22 mm)
	L1	LE
hp	Adder U.S. $	Adder U.S. $
7-1/2 – 400		

Table 40-344. 480V and 575V Control Options

Catalog Number Suffix ➡	Door-Mounted Speed Potentiometer	Door-Mounted Speed Potentiometer with HOA Selector Switch	3 – 15 psig Follower	HAND/ OFF/ AUTO Switch (22 mm)	MANUAL/ AUTO Ref Switch (22 mm)	START/ STOP Pushbuttons (22 mm)	Standard Elapsed Time Meter	Input Power Surge Protection MOV	TVSS Transient Voltage Surge Suppressor
	K1	K2	K3	K4	K5	K6	KO	P7	P8
hp	Adder U.S. $	Adder U.S. $	Adder U.S. $	Adder U.S. $	Adder U.S. $	Adder U.S. $	Adder U.S. $	Adder U.S. $	Adder U.S. $
7-1/2 – 400									

Table 40-345. 480V and 575V Bypass Options ①

Catalog Number Suffix ➡	Bypass Test Switch for RA, RB, RC, RD	Bypass Pilot Lights for RA, RB Options	Dual Overloads for Bypass	Manual HOA Bypass Controller	Manual IOB Bypass Controller	Auto Transfer HOA Bypass Controller	Auto Transfer IOB Bypass Controller	Reduced Volt Starter for Bypass
	KF	L2	PN	RA	RB	RC	RD	RG
hp	Adder U.S. $	Adder U.S. $	Adder U.S. $	Adder U.S. $	Adder U.S. $	Adder U.S. $	Adder U.S. $	Adder U.S. $
7-1/2 10 15 20								
25 30 40 50 60								
75 100 125 150 200								
250 300 350 400								

① See **Pages 40-224** and **40-225** for details.

Table 40-346. 480V and 575V Enclosure Options

Catalog Number Suffix ➡	Floor Stand 6" (152.4 mm)	Floor Stand 22" (558.8 mm)	Floor Stand 12" (304.8 mm)	Space Heater ②
	S4	S5	S6	S9
Enclosure Size	Adder U.S. $	Adder U.S. $	Adder U.S. $	Adder U.S. $
7 8 9				
B				
C				
E				

② Requires customer supplied 115V AC supply.

Discount Symbol **SS-3**

Table 40-347. 480V and 575V Power Options

Catalog Number Suffix ➡	Input		Output				
	Input Disconnect Thermo-mag Breaker 65 kAIC	Input Line Fuses 200 kAIC	Output Contactor	Output Filter ①	MotoRx (300 – 600 Ft.) 1000 V/µS DV/DT Filter ①	Single Overload Relay ②	Dual Overload Relays ②
	P1	P3	PE	PF	PG	PH	PI
hp	Adder U.S. $	Adder U.S. $	Adder U.S. $	Adder U.S. $	Adder U.S. $	Adder U.S. $	Adder U.S. $
7-1/2 10 15 20							
25 30 40 50 60							
75 100 125 150 200							
250 300 350 400							

① Output filter may be required whenever the distance from the drive to the motor exceeds 100 feet (30m). Refer to Application Notes for further details.
② Heater packs not included.

Discount Symbol SS-3

Dimensions

Enclosure Box B — UL Type 12

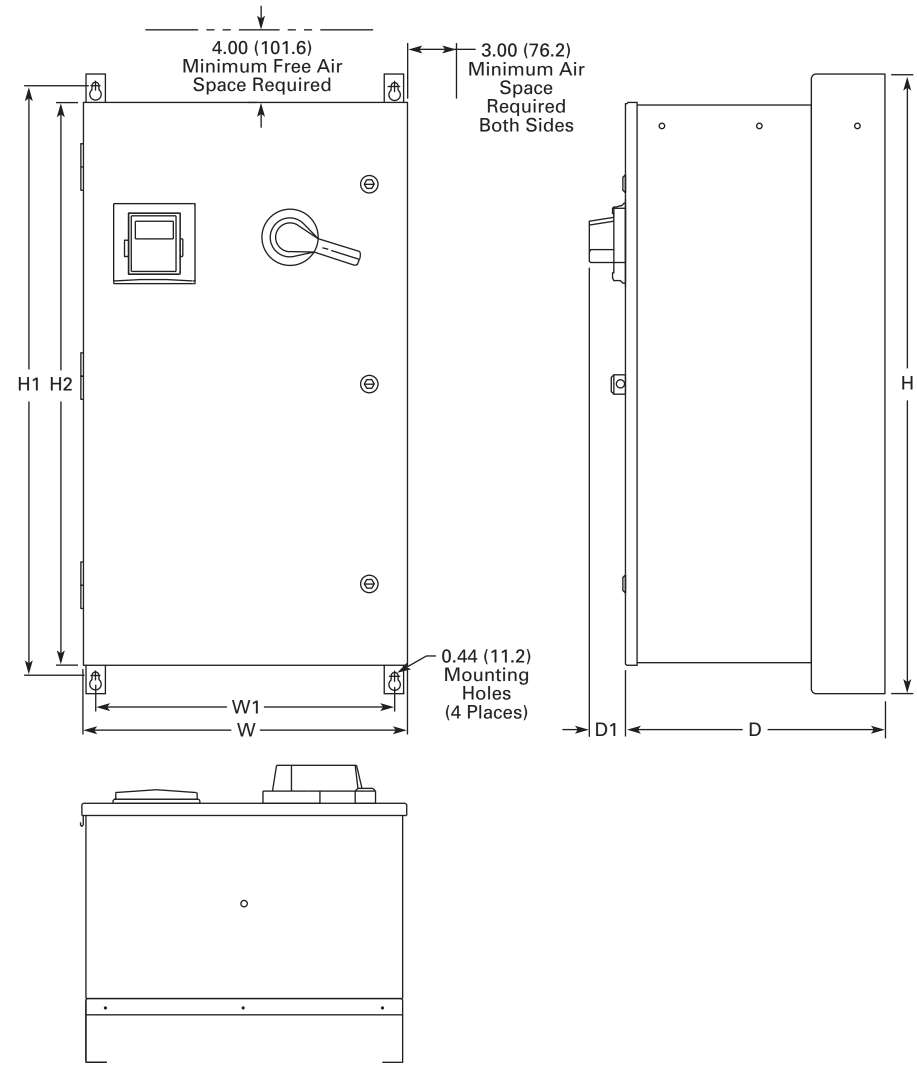


Figure 40-127. Enclosure Box B — UL Type 12 Dimensions

Table 40-348. Enclosure Box B — UL Type 12 Dimensions

Approximate Dimensions in Inches (mm)							Approx. Weight Lbs. (kg)	Approx. Ship Weight Lbs. (kg)
H	**H1**	**H2**	**W**	**W1**	**D**	**D1**		
40.00 (1016.0)	38.00 (965.2)	36.35 (923.3)	20.92 (531.4)	19.30 (490.2)	16.76 (425.7)	2.34 (59.4)	185 (84)	229 (104)

Enclosure Box C — UL Type 12

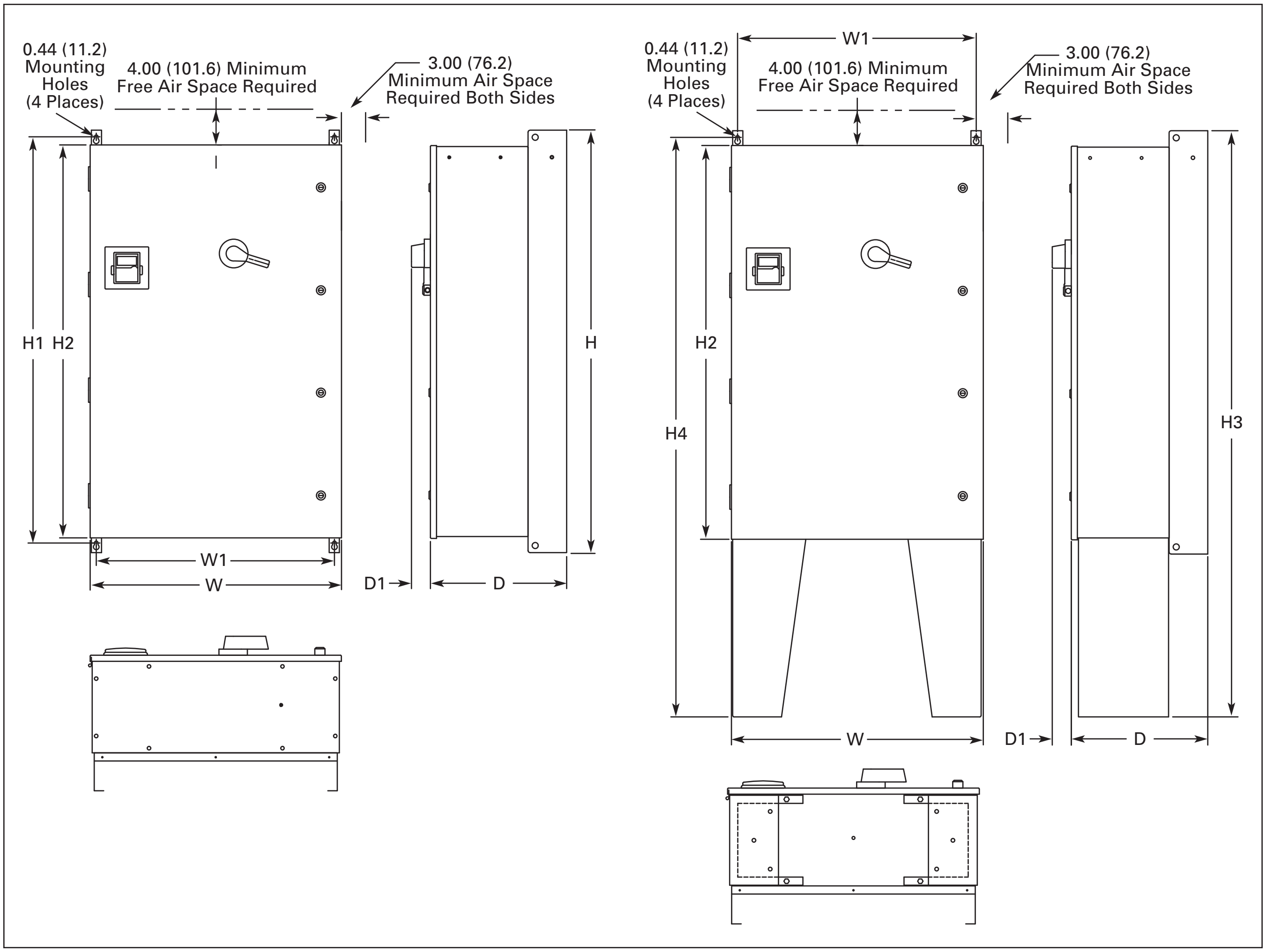


Figure 40-128. Enclosure Box C — UL Type 12 Dimensions

Table 40-349. Enclosure Box C — UL Type 12 Dimensions

Approximate Dimensions in Inches (mm)									Approx. Weight Lbs. (kg)	Approx. Ship Weight Lbs. (kg)
H	H1	H2	H3	H4	W	W1	D	D1		
52.00 (1320.8)	50.00 (1270.0)	48.35 (1228.1)	72.00 (1828.8)	71.19 (1808.2)	30.92 (785.4)	29.30 (744.2)	16.78 (426.2)	2.34 (59.4)	320 (145)	435 (197)

Enclosure Box B — UL Type 3R

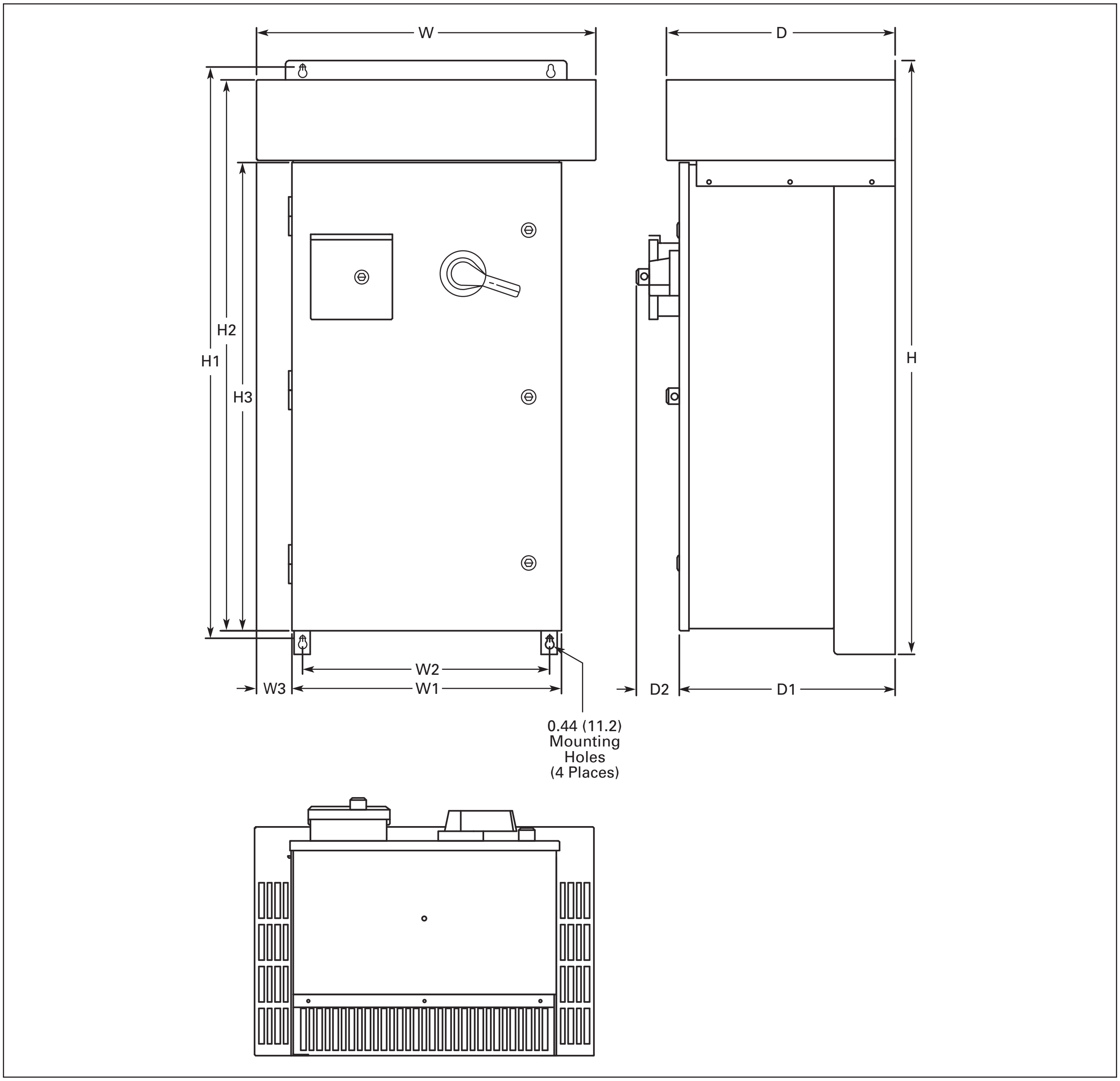


Figure 40-129. Enclosure Box B — UL Type 3R Dimensions

Table 40-350. Enclosure Box B — UL Type 3R Dimensions

Approximate Dimensions in Inches (mm)											Approx. Weight Lbs. (kg)	Approx. Ship Weight Lbs. (kg)
H	H1	H2	H3	W	W1	W2	W3	D	D1	D2		
46.09 (1170.7)	44.45 (1129.0)	42.77 (1086.4)	36.35 (923.3)	26.31 (668.3)	20.92 (531.4)	19.30 (490.2)	2.69 (68.3)	17.74 (450.6)	16.76 (425.7)	3.31 (84.1)	235 (107)	290 (132)

Enclosure Type C — UL Type 3R

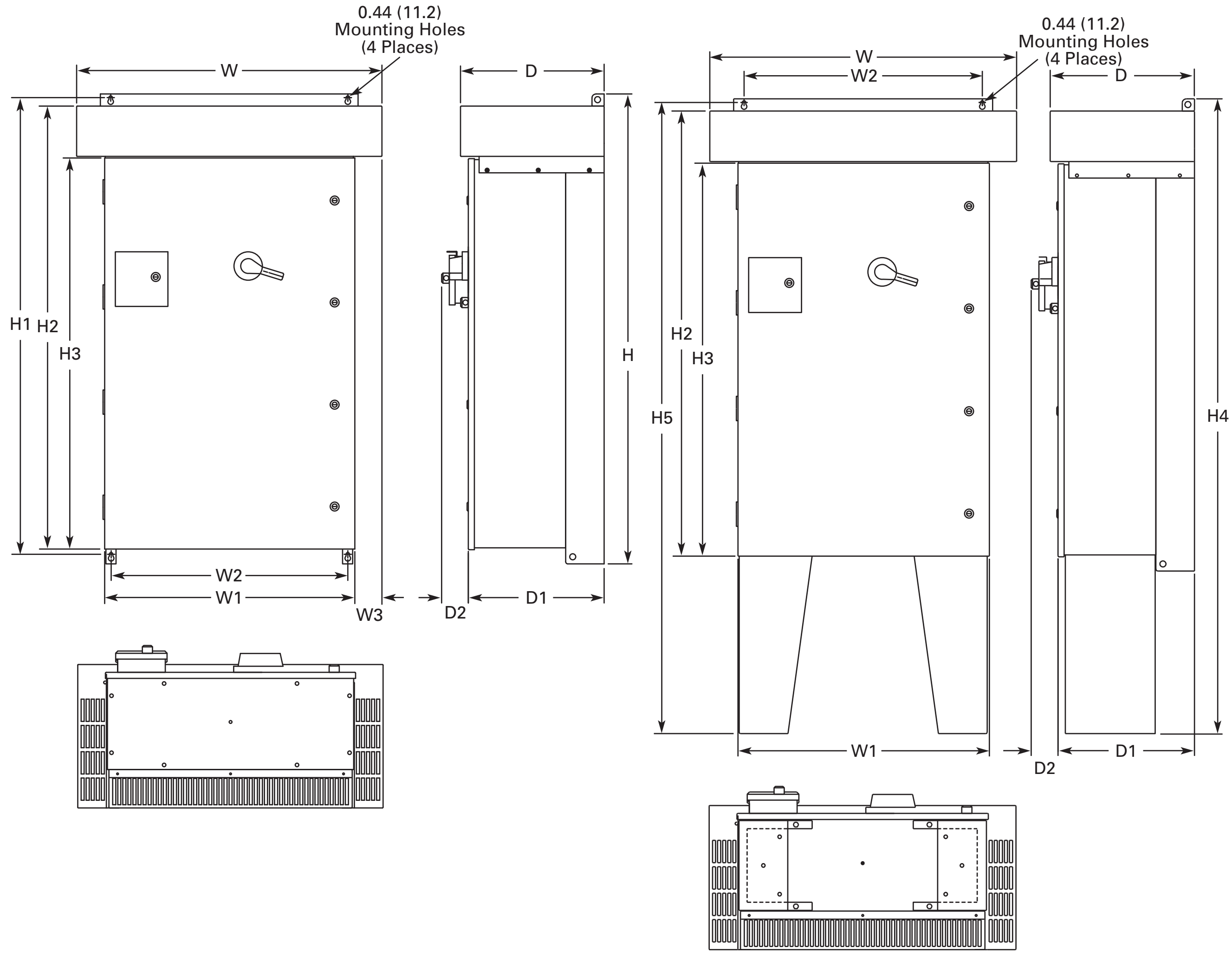
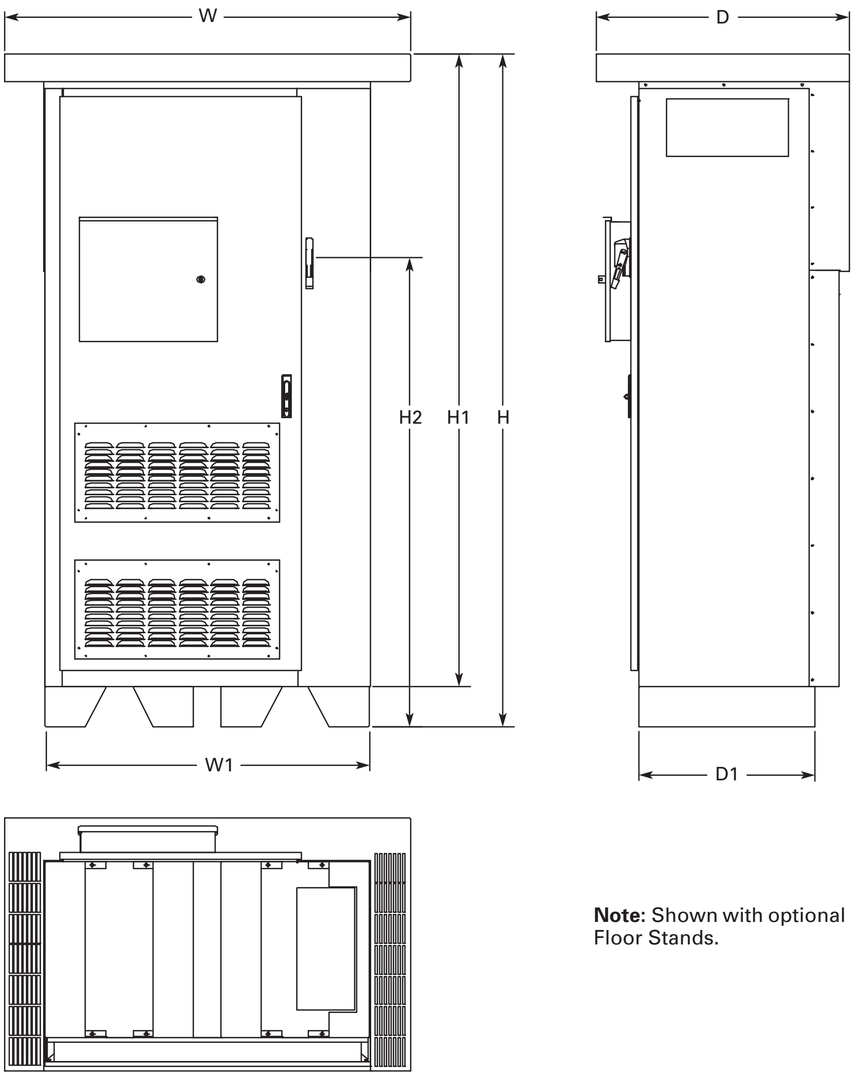


Figure 40-130. Enclosure Box C — UL Type 3R Dimensions

Table 40-351. Enclosure Box C — UL Type 3R Dimensions

Approximate Dimensions in Inches (mm)													Approx. Weight Lbs. (kg)	Approx. Ship Weight Lbs. (kg)
H	H1	H2	H3	H4	H5	W	W1	W2	W3	D	D1	D2		
58.09 (1475.5)	56.45 (1433.8)	54.77 (1391.2)	48.35 (1228.1)	78.09 (1983.5)	77.64 (1972.1)	37.73 (958.3)	30.92 (785.4)	29.30 (744.2)	3.34 (84.8)	17.74 (450.6)	16.77 (426.0)	3.31 (84.1)	370 (168)	485 (220)

Enclosure Size E



Note: Shown with optional Floor Stands.

Figure 40-131. Enclosure Box E — UL Type 3R Dimensions

Table 40-352. Enclosure Box E — UL Type 3R Dimensions

Approximate Dimensions in Inches (mm)							Approx. Weight Lbs. (kg)	Approx. Ship Weight Lbs. (kg)
H	H1	H2	W	W1	D	D1		
99.58 (2529.3)	93.58 (2376.9)	69.51 (1765.6)	60.00 (1524.0)	48.00 (1219.2)	37.50 (952.5)	26.00 (660.4)	1,700 (771)	1,850 (839)

Enclosure Size 7

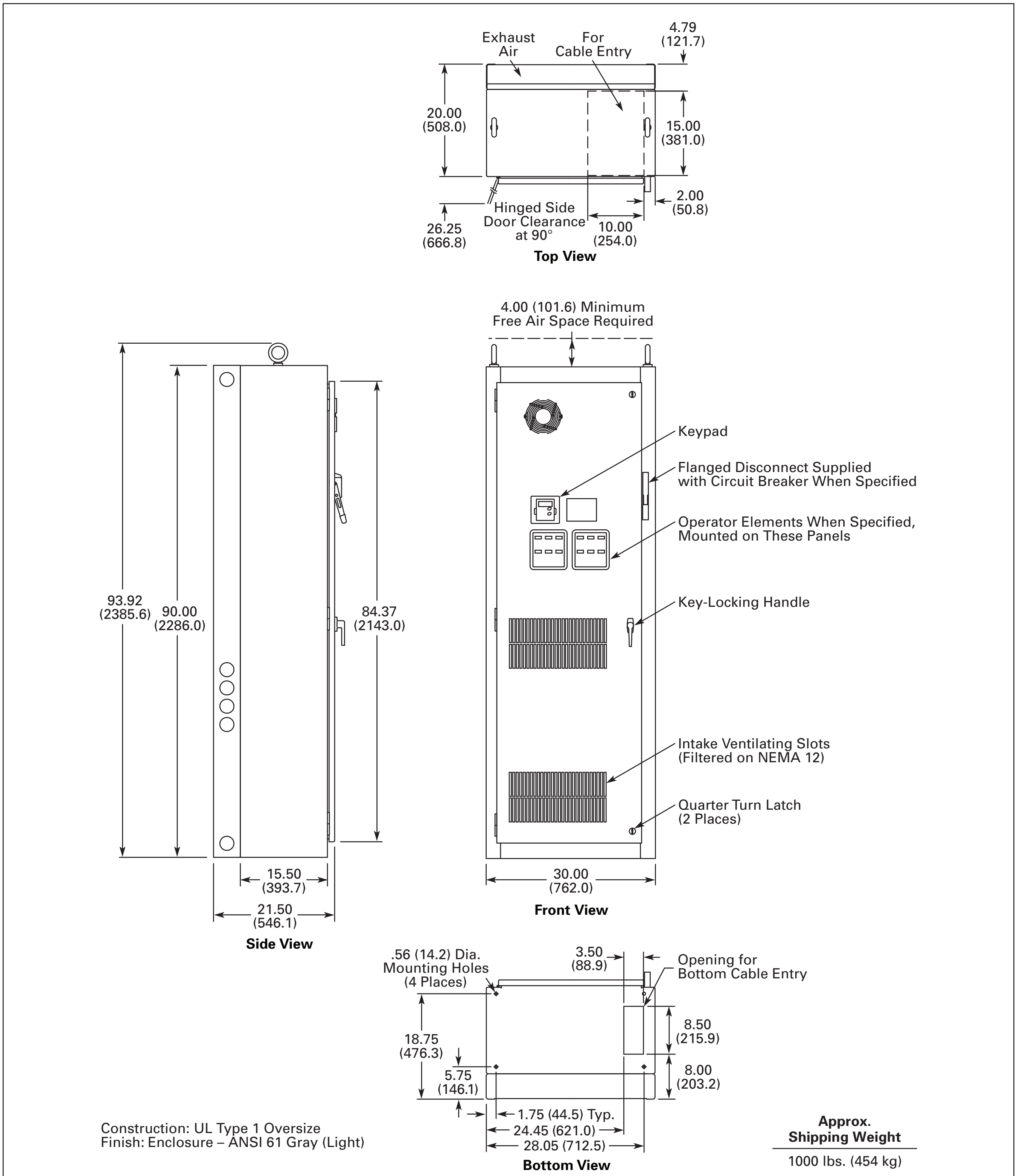


Figure 40-132. Approximate Dimensions in Inches (mm)

Enclosure Size 8

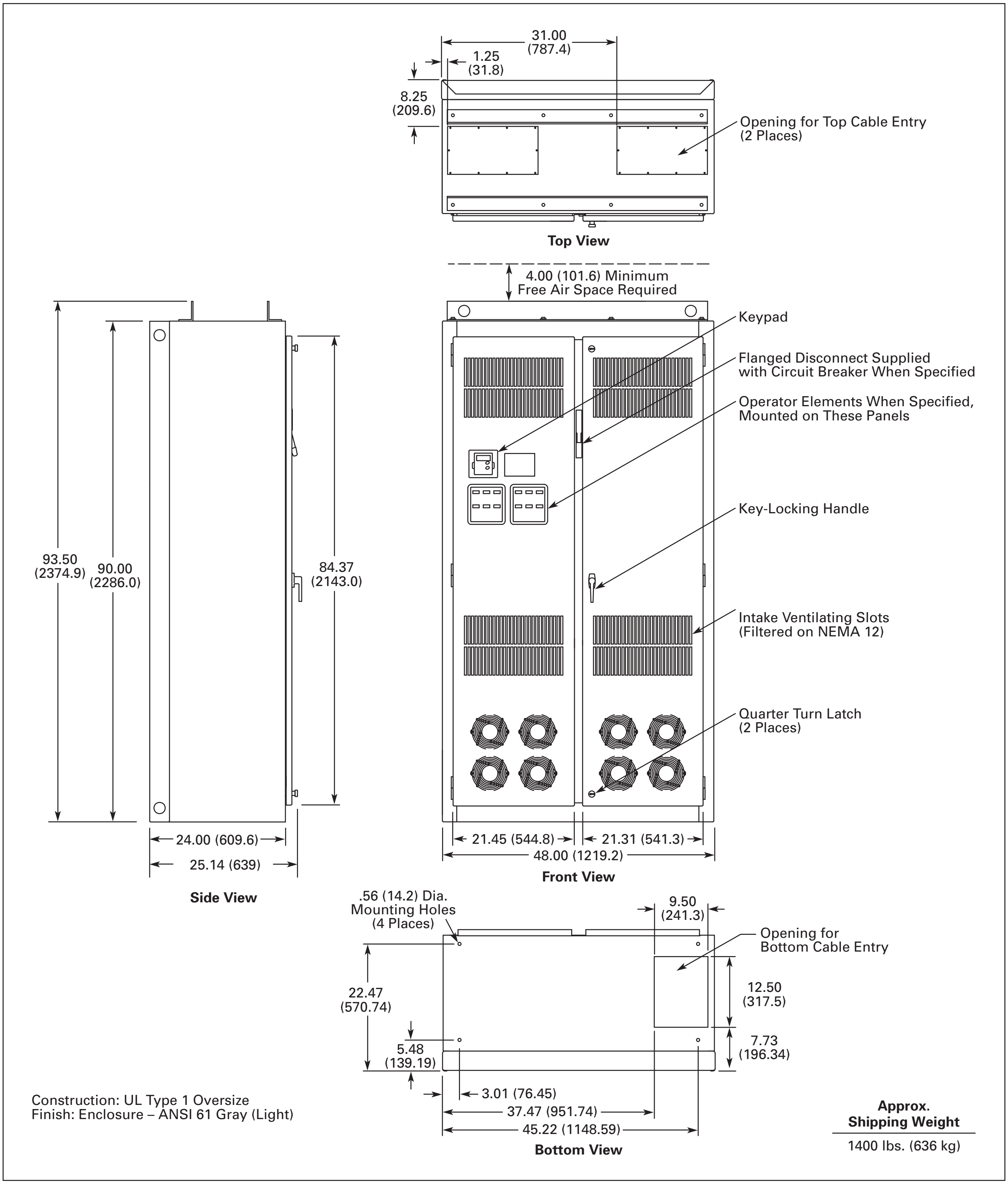
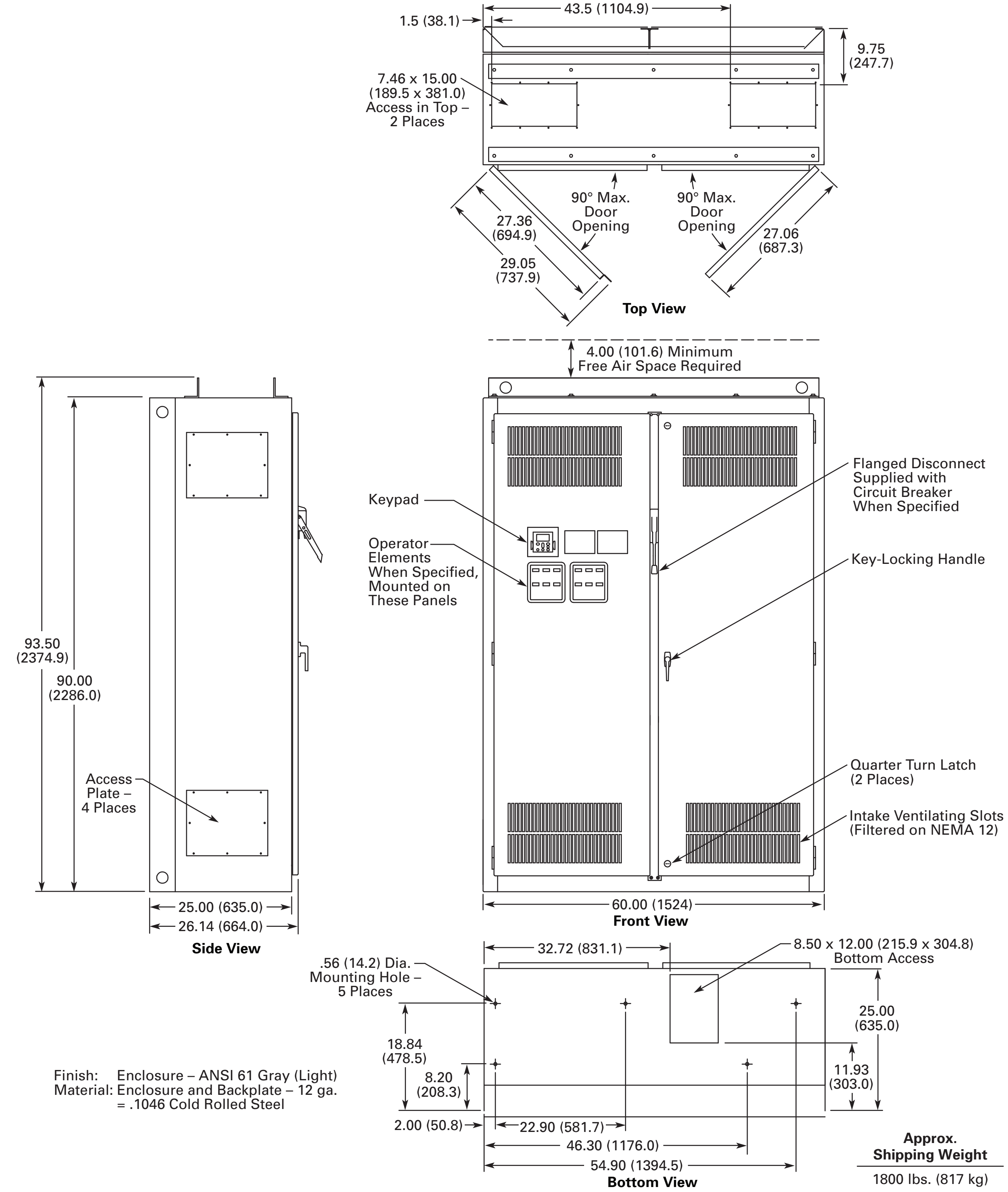


Figure 40-133. Approximate Dimensions in Inches (mm)

Enclosure Size 9



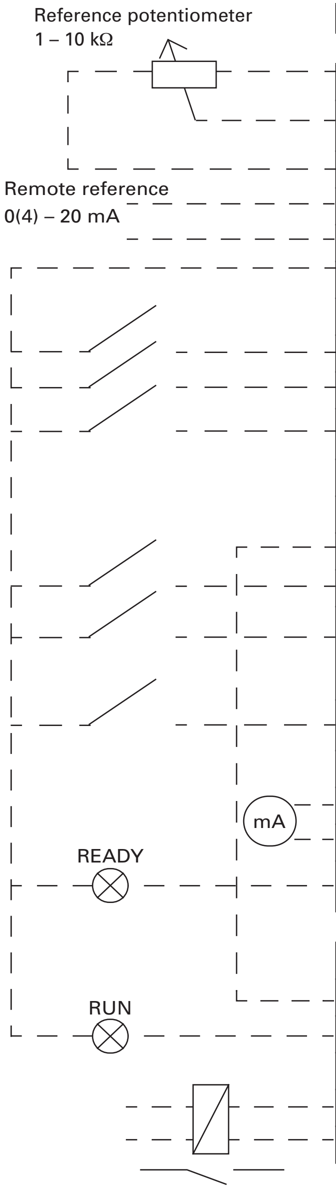
Approx. Shipping Weight
1800 lbs. (817 kg)

Figure 40-134. Approximate Dimensions in Inches (mm)

Wiring Diagram

Control Input/Output

Table 40-353. Basic Application Default I/O Configuration



Terminal		Signal	Description
OPTA9			
1	$+10V_{ref}$	Reference output	Voltage for potentiometer, etc.
2	AI1+	Analog input, voltage range 0 – 10V DC	Voltage input frequency reference
3	AI1-	I/O Ground	Ground for reference and controls
4	AI2+	Analog input, current range 0 – 20 mA	Current input frequency reference
5	AI2-		
6	+24V	Control voltage output	Voltage for switches, etc. max 0.1A
7	GND	I/O ground	Ground for reference and controls
8	DIN1	Start forward	Contact closed = start forward
9	DIN2	Start reverse	Contact closed = start reverse
10	DIN3	External fault input (programmable)	Contact open = no fault Contact closed = fault
11	CMA	Common for DIN 1 – DIN 3	Connect to GND or +24V
12	+24V	Control voltage output	Voltage for switches (see terminal 6)
13	GND	I/O ground	Ground for reference and controls
14	DIN4	Multi-step speed select 1	**DIN4** / **DIN5** / **Frequency ref.**
15	DIN5	Multi-step speed select 2	Open / Open / $Ref.V_{in}$ Closed / Open / Multi-step ref.1 Open / Closed / Multi-step ref.2 Closed / Closed / Ref_{Max}
16	DIN6	Fault reset	Contact open = no action Contact closed = fault reset
17	CMB	Common for DIN4 – DIN6	Connect to GND or +24V
18	AO1+	Output frequency Analog output	Programmable Range 0 – 20 mA, R_L max. 500Ω
19	AO1-		
20	DO1	Digital output READY	Programmable Open collector, I ≤ 50 mA, V ≤ 48V DC
OPTA2			
21	RO1	Relay output 1 RUN	
22	RO1		
23	RO1		
24	RO2	Relay output 2 FAULT	
25	RO2		
26	RO2		

Contents



CPX9000 — 150 hp I_L

Product Description

The Cutler-Hammer® CPX9000 Clean Power Drives from Eaton's electrical business use advanced 18-pulse, clean power technology that significantly reduces line harmonics at the drive input terminals, resulting in one of the purest sinusoidal waveforms available.

Enhancements to the CPX9000 Clean Power Drives include smaller enclosures and higher temperature ratings than CP9000 for selected drives.

The CPX9000 drive also delivers True Power Factor — in addition to reducing harmonic distortion, the CPX9000 drive prevents transformer overheating and overloading of breakers and feeders, which enables the application of adjustable frequency drives on generators and other high impedance power systems.

The 9000X Family of Drives includes HVX9000, SVX9000, SLX9000 and SPX9000. 9000X Series drive ratings are rated for either high overload (I_H) or low overload (I_L). I_L indicates 110% overload capacity for 1 minute out of 10 minutes. I_H indicates 150% overload capacity for 1 minute out of 10 minutes.

CPX9000 Enclosed Products Program

- **Standard Enclosed** — covers a wide range of the most commonly ordered options. Pre-engineering eliminates the lead time normally associated with customer specific options. Available configurations are listed on **Pages 40-248 – 40-255**.
- **Modified Standard Enclosed** — applies to specific customer requirements that vary from the Standard Enclosed offering, such as the need for an additional indicating light or minor modifications to drawings. *Contact your local sales office for assistance in pricing and lead time.*
- **Custom Engineered** — for those applications with more unique or complex requirements, these are individually engineered to the customer's needs. *Contact your local sales office for pricing and lead time.*

Features and Benefits

New CPX9000 Clean Power Drive features include:

- Space optimized enclosure
- Simple layout for power options
- NEMA Type 1, NEMA 12 with Gaskets and Filters, NEMA Type 3R
- Input Voltage: 480V, 208/230V, 575V
- Complete range of control, network and power options
- Horsepower range:
  - 480V, 25 – 700 hp I_H; 25 – 800 hp I_L; consult factory for larger sizes
  - 208/230V, 25 – 100 hp I_L: consult factory for details and pricing
  - 575V, 25 – 500 hp I_L; consult factory for larger sizes
- Over ten years of 18-pulse Clean Power experience
- UL 508C tested, listed and approved
- 65 KAIC Standard at 480V and 208V
- 100 KAIC optional

Application Description

Designed to exceed the IEEE 519-1992 requirements for harmonic distortion, the CPX9000 is the clear choice for applications in the water, wastewater, HVAC, industrial and process industries where harmonics are a concern.

What Are Harmonics?

Take a perfect wave with a fundamental frequency of 60 Hz, which is close to what is supplied by the power company.

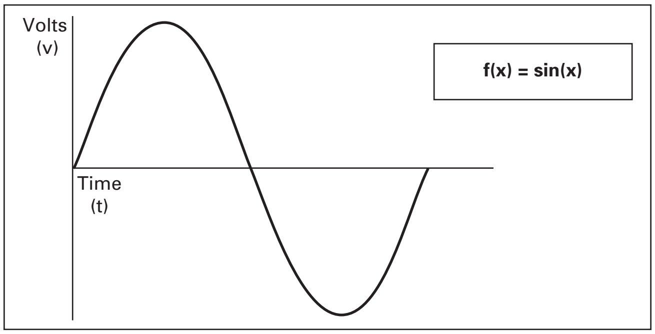


Figure 40-135. Perfect Wave

Add a second wave that is five times the fundamental frequency — 300 Hz (Typical of frequency added to the line by a fluorescent light).

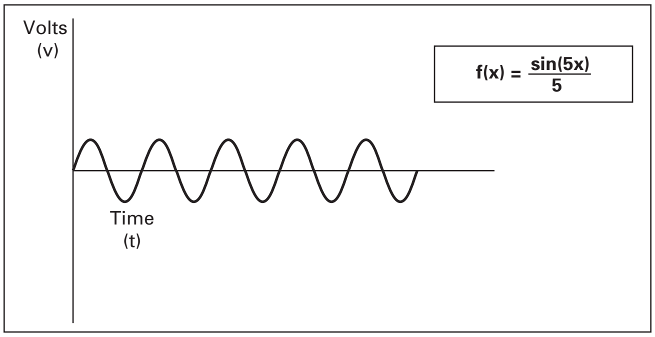


Figure 40-136. Second Wave

Combine the two waves. The result is a 60 Hz supply rich in fifth harmonics.

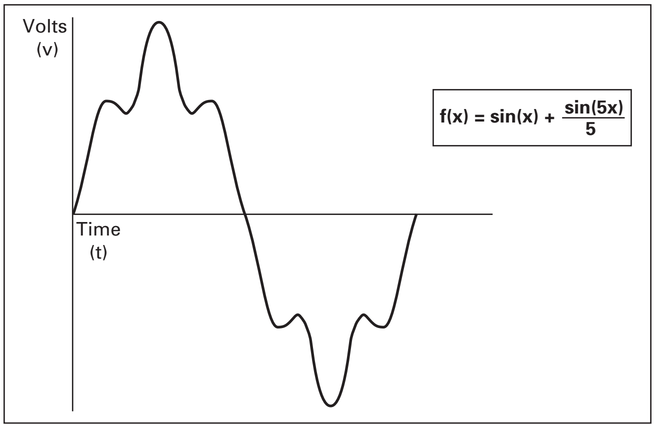


Figure 40-137. Resulting Supply

What Causes Harmonics?

Harmonics are the result of nonlinear loads that convert AC line voltage to DC. Examples of equipment that are non-linear loads are listed below:

- AC variable frequency drives
- DC drives
- Fluorescence lighting, computers, UPS systems
- Industrial washing machines, punch presses, welders, etc.

How Can Harmonics Due to VFDs Be Diminished?

By purchasing Eaton's patented 18-Pulse Cutler-Hammer drive that is guaranteed to meet IEEE Std. 519-1992 Harmonic Distortion Limits.

What Are Linear Loads?

Linear loads are primarily devices that run across the line and do not add harmonics. Motors are prime examples. The downside to having large motor linear loads is that they draw more energy than a VFD, because of their inability to control motor speed. In most applications there is a turn down valve used with the motor which will reduce the flow of the material, without significantly reducing the load to the motor. While this provides some measure of speed control, it is extremely inefficient.

Why Be Concerned About Harmonics?

1. ***Installation and utility costs increase.*** Harmonics cause damage to transformers and lower efficiencies due to the IR loss. These losses can become significant (from 16.6 – 21.6%) which can have a dramatic effect on the HVAC systems that are controlling the temperatures of the building where the transformer and drive equipment reside.
2. ***Downtime and loss of productivity.*** Telephones and data transmissions links may not be guaranteed to work on the same power grids polluted with harmonics.
3. ***Downtime and nuisance trips of drives and other equipment.*** Emergency generators have up to (3) three times the impedance that is found in a conventional utility source. Thus the harmonic voltage can be up to three times as large, causing risk of operation problems.
4. ***Larger motors must be used.*** Motors running across the line that are connected on polluted power distribution grids can overheat or operate at lower efficiency due to harmonics.
5. ***Higher installation costs.*** Transformers and power equipment must be oversized to accommodate the loss of efficiencies. This is due to the harmonic currents circulating through the distribution without performing useful work.

How Does a VFD Convert 3-Phase AC to a Variable Output Voltage and Frequency?

The 6-pulse VFD: The majority of all conventional drives that are built consist of a 6-pulse configuration. **Figure 40-138** represents a 6-diode rectifier design that converts three-phase utility power to DC. The inverter section uses IGBTs to convert DC power to a simulated AC sine wave that can vary in frequency from 0 – 400 Hz.

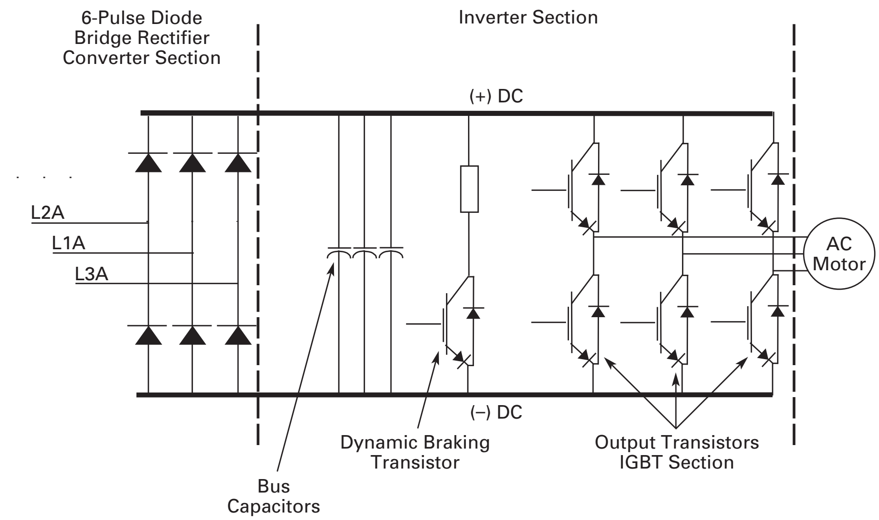


Figure 40-138. 6-Diode Rectifier Design

The 6-Pulse VFD drive creates harmonic current distortion. The harmonic current that is created is energy that can not be used by customers and causes external heat and losses to all components including other drives that are on the same power distribution. **Figure 40-139** is a 500 hp drive with 167A of damaging harmonic current.

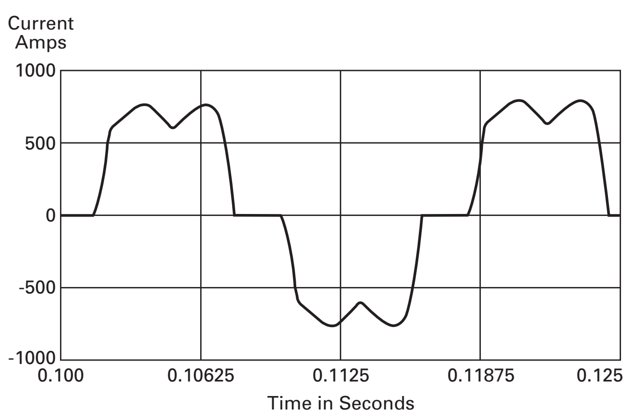


Figure 40-139. 6-Pulse Nonproductive Harmonic Current

Table 40-354. 6-Pulse Nonproductive Harmonic Current

6-Pulse Circuit		
Current Harmonics		
I_1 = 100%	I_{11} = 6.10%	I_{19} = 1.77%
I_5 = 22.5%	I_{13} = 4.06%	I_{23} = 1.12%
I_7 = 9.38%	I_{17} = 2.26%	I_{25} = 0.86%
Power = 500 hp		
Harmonic Current = 167 Amps		

Guidelines of Meeting IEEE Std. 519-1992 Harmonic Distortion Limits

The IEEE 519-1992 Specification is a standard that provides guidelines for commercial and industrial users that are implementing medium and low voltage equipment.

Table 40-355. Maximum Harmonic Current Distortion in % of the Fundamental (120V through 69,000V)

I_{sc}/I_L	Harmonic Order (Odd Harmonics)					TDD
	h<11	11≤h<17	17≤h<23	23≤h<35	35≤h	
<20	4.0	2.0	1.5	0.6	0.3	5.0
20<50	7.0	3.5	2.5	1.0	0.5	8.0
50<100	10.0	4.5	4.0	1.5	0.7	12.0
100<1000	12.0	5.5	5.0	2.0	1.0	15.0
>1000	15.0	7.0	6.0	2.5	1.4	20.0

The ratio ISC/IL is the ratio of the short-circuit current available at the point of common coupling (PCC), to the maximum fundamental load current. Consequently, as the size of the user load decreases with respect to the size of the system, the percentage of harmonic current that the user is allowed to inject into the utility system increases.

Notes:
TDD = Total demand distortion is the harmonic current distortion in percent of the maximum demand load current (15 or 30 minute demand).

I_{SC} = Maximum short circuit current at the PCC not counting motor contribution.

I_L = Maximum demand load current for all of the connected loads (fundamental frequency component) at the PCC.
All of the limits are measured at a point of common coupling.

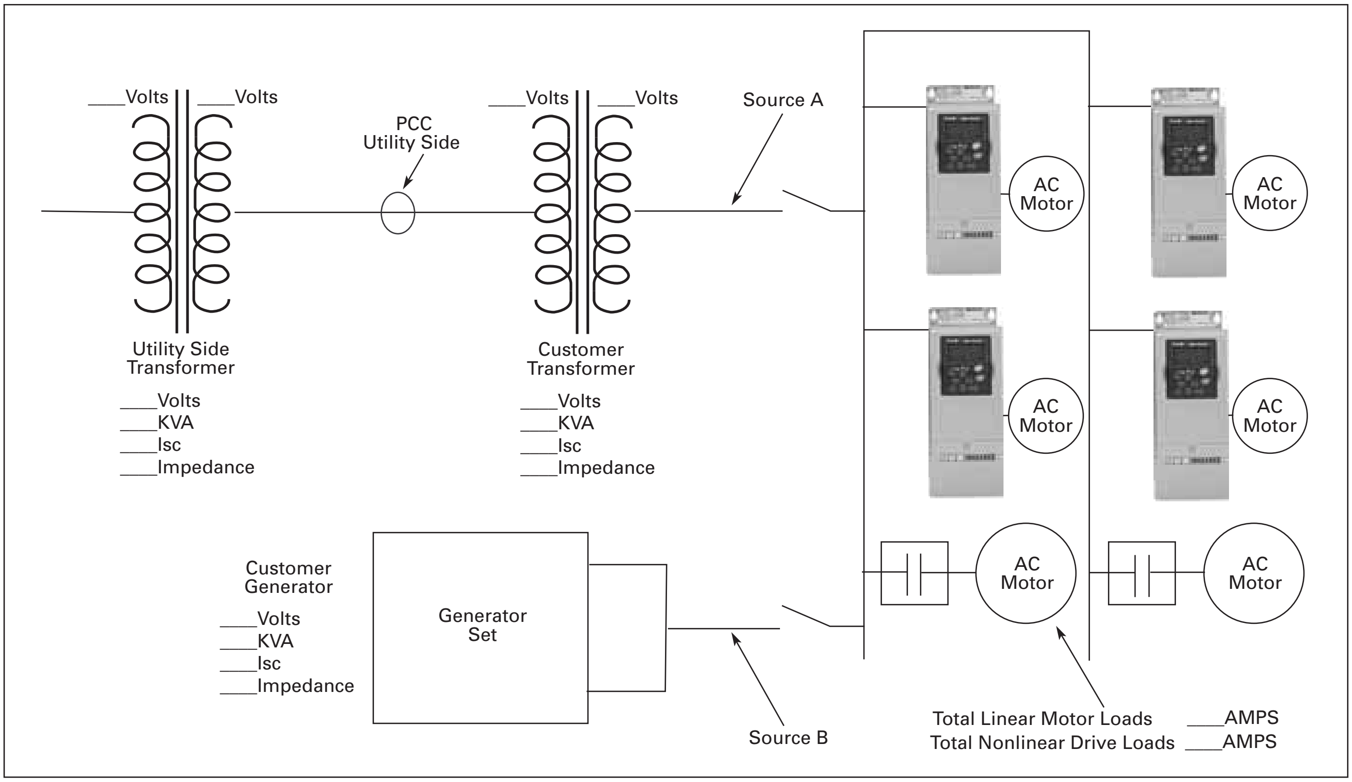


Figure 40-140. Oneline Diagram for Harmonic Analysis

The best way to estimate AFD harmonic contribution to an electrical system is to perform a harmonic analysis based on known system characteristics. The oneline in this Figure would provide the data to complete the calculations.

Terms

- PCC (Point of Common Coupling) is defined as the electrical connecting point between the utility and multiple customers per the specifications in IEEE 519.
- POA (Point of Analysis) is defined as where the harmonic calculations are taken.

An oscilloscope can make all measurements at the PCC or POA to do an on-site harmonic evaluation.

Harmonic Reduction Methods to Meet IEEE 519

1. Line Reactor

A line reactor is a 3-phase series inductance on the line side of an AFD. If a line reactor is applied on all AFDs, it is possible to meet IEEE guidelines where 10 – 25% of system loads are AFDs, depending on the stiffness of the line and the value of line reactance. Line reactors are available in various values of impedance, most typically 1 – 1.5%, 3% and 5%.

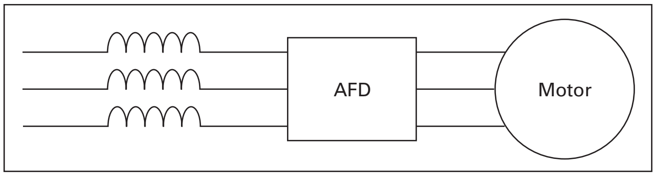


Figure 40-141. Line Reactor

Advantages

- Low cost
- Can provide moderate reduction in voltage and current harmonics
- Available in various values of impedance
- Provides increased input protection for AFD and its semiconductors from line transients

Disadvantages

- May not reduce harmonic levels to below IEEE 519-1992 guidelines
- Voltage drop due to IR loss

2. 12-Pulse Converters

A 12-pulse converter incorporates two separate AFD input semiconductor bridges, which are fed from 30° phase shifted power sources with identical impedance. The sources may be two isolation transformers, where one is a delta/wye design (which provides the phase shift) and the second a delta/delta design (which does not phase shift). The 12-pulse arrangement allows the harmonics from the first converter to cancel the harmonics of the second. Up to approximately 85% reduction of harmonic current and voltage distortion may be achieved (over standard 6-pulse converter). This permits a facility to use a larger percentage of AFD loads under IEEE 519-1992 guidelines than allowable using line reactors or DC chokes. A harmonic analysis is required to guarantee compliance with guidelines.

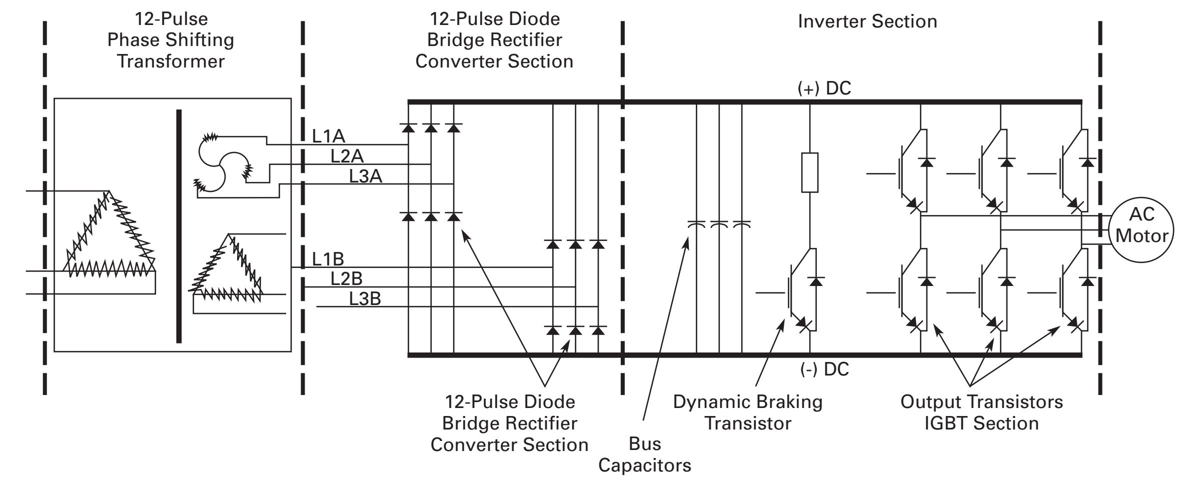


Figure 40-142. Basic 12-Pulse Rectifier with "Phase Shifting" Transformer

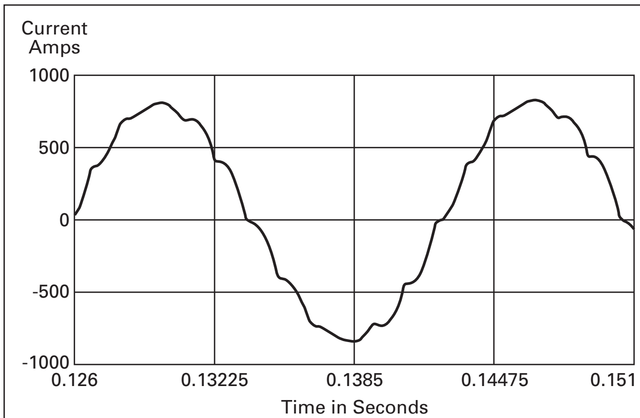


Figure 40-143. 500 hp 480V Drive with 12-Pulse Rectifier

Table 40-356. 500 hp 480V Drive with 12-Pulse Rectifier

12-Pulse Circuit		
Current Harmonics		
I_1 = 100%	I_{11} = 4.19%	I_{19} = 0.06%
I_5 = 1.25%	I_{13} = 2.95%	I_{23} = 0.87%
I_7 = 0.48%	I_{17} = 0.21%	I_{25} = 0.73%
Power = 500 hp		
H_C = 66.2 Amps		

Advantages

- Moderate cost, although significantly more than reactors or chokes
- Substantial reduction (up to approx. 85%) in voltage and current harmonics
- Provides increased input protection for AFD and its semiconductors from line transients

Disadvantages

- Impedance matching of phase shifted sources is critical to performance
- Transformers often require separate mounting or larger AFD enclosures
- May not reduce distribution harmonic levels to below IEEE 519-1992 guidelines
- Cannot retrofit for most AFDs

3. Clean Power Drives

When the total load is of non-linear, the greatest harmonic mitigation is required. Under these conditions, the currents drawn from the supply need to be sinusoidal and "clean" such that system interference and additional losses are negligible. The Cutler-Hammer CPX9000 Clean Power Drive uses a phase-shifting auto transformer with delta-connected winding. Three of the output phases are advanced and three are retarded. The remaining three phases of this nine-phase supply are in phase with the incoming line. This results in nine separate phases. In this type of configuration, the total required KVA rating of the transformer is only 48% of a drive rate isolation transformer. A traditional isolated transformer system, with multipulse windings, would require the full KVA rating to be supported, which is more common in an MV step-down transformer.

The integrated 18-pulse clean power drive, with near sine wave input current and low harmonics will meet the requirements of IEEE 519-1992 under all practical operating conditions. The comparisons with 6-pulse and 12-pulse systems are shown in **Figures 40-139**, **40-143** and **40-145**.

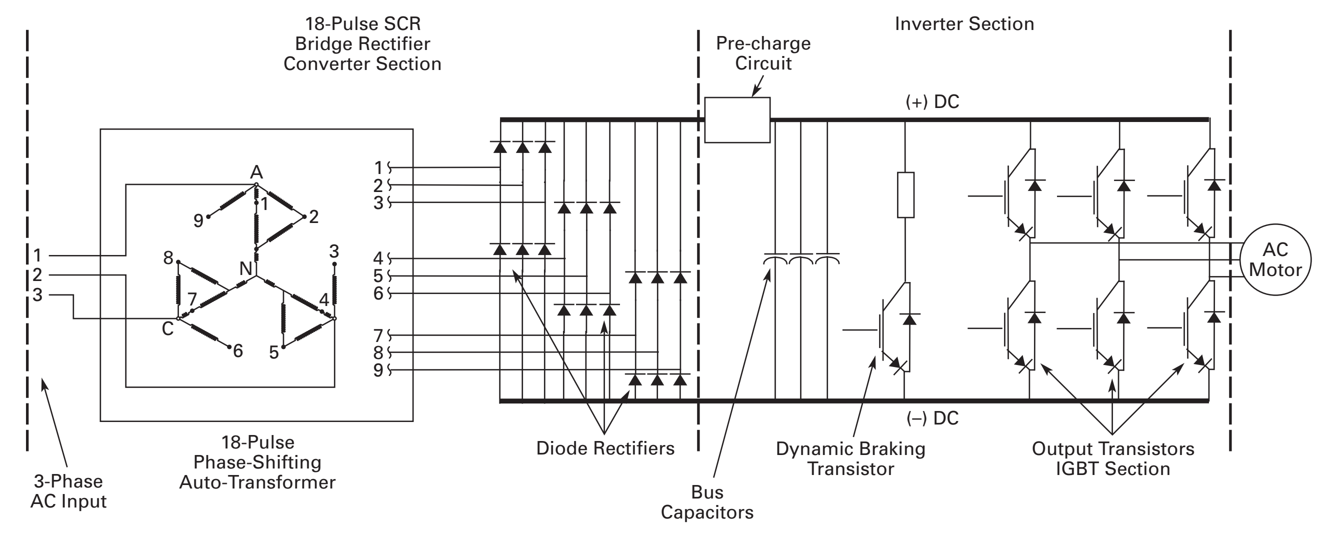


Figure 40-144. Basic 18-Pulse Rectifier with "Differential Delta" Transformer

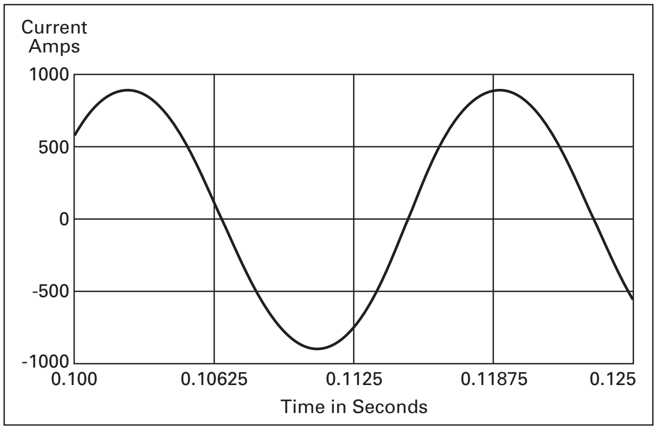


Figure 40-145. 500 hp 480V Drive with 18-Pulse Rectifiers

Table 40-357. 500 hp 480V Drive with 18-Pulse Rectifiers

18-Pulse Clean Power		
Current Harmonics		
I_1 = 100%	I_{11} = 0.24%	I_{19} = 1.00%
I_5 = 0.16%	I_{13} = 0.10%	I_{23} = 0.01%
I_7 = 0.03%	I_{17} = 0.86%	I_{25} = 0.01%
Power = 500 hp		
H_c = 24 Amps		

Advantages

- Virtually guarantees compliance with IEEE 519-1992
- Provides increased input protection for AFD and its semiconductors from line transients
- Up to 4 times the harmonic reduction of 12-pulse methods
- Smaller transformer than isolation transformer used in 12-pulse converter

Disadvantages

- Larger and heavier magnetics than some other methods

40

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Technical Data and Specifications

Table 40-358. Specifications

Feature Description	CPX9000 Enclosed Products — NEMA Type 1 & NEMA 12 Filtered
Primary Design Features	
45 – 66 Hz Input Frequency	Standard
Output: AC Volts Maximum	Input Voltage Base
Output Frequency Range: Hz	0 – 400
Initial Output Current (I_H)	250% for 2 seconds
Overload: 1 Minute (I_H/I_L)	150%/110%
Enclosure Space Heater	Optional
Oversize Enclosure	Standard
Output Contactor	Optional
Bypass Motor Starter	Optional
Listings	UL, cUL
Protection Features	
Incoming Line Fuses	Standard 200 KAIC Rating
AC Input Circuit Disconnect	Optional
Phase Rotation Insensitive	Standard
EMI Filter	FR6 – FR9 ①
Input Phase Loss Protection	Standard
Input Overvoltage Protection	Standard
Line Surge Protection	Standard
Output Short Circuit Protection	Standard
Output Ground Fault Protection	Standard
Output Phase Protection	Standard
Overtemperature Protection	Standard
DC Overvoltage Protection	Standard
Drive Overload Protection	Standard
Motor Overload Protection	Standard
Programmer Software	Optional
Local/Remote Keypad	Standard
Keypad Lockout	Standard
Fault Alarm Output	Standard
Built-In Diagnostics	Standard
MOV	Standard
Input/Output Interface Features	
Setup Adjustment Provisions:	
Remote Keypad/Display	Standard
Personal Computer	Standard
Operator Control Provisions:	
Drive Mounted Keypad/Display	Standard
Remote Keypad/Display	Standard
Conventional Control Elements	Standard
Serial Communications	Optional
115V AC Control Circuit	Standard
Speed Setting Inputs:	
Keypad	Standard
0 – 10V DC Potentiometer/Voltage Signal	Standard
4 – 20 mA Isolated	Configurable
4 – 20 mA Differential	Configurable
3 – 15 psig	Optional
Analog Outputs:	
Speed/Frequency	Standard
Torque/Load/Current	Programmable
Motor Voltage	Programmable
Kilowatts	Programmable
0 – 10V DC Signals	Configurable w/Jumpers
4 – 20 mA DC Signals	Standard
Isolated Signals	Optional

① The EMI filter is optional in FR10 and larger.

Feature Description	CPX9000 Enclosed Products — NEMA Type 1 & NEMA 12 Filtered
Input/Output Interface Features (Continued)	
Discrete Outputs:	
Fault Alarm	Standard
Drive Running	Standard
Drive at Set Speed	Programmable
Optional Parameters	14
Dry Contacts	2 Form C Contacts Available
Open Collector Outputs	1
Additional Discrete Outputs	Optional
Communications:	
RS-232	Standard
RS-422/485	Optional
DeviceNet™	Optional
Modbus RTU	Optional
CanOpen (Slave)	Optional
Profibus-DP	Optional
Lonworks®	Optional
Johnson Controls Metasys™ N2	Optional
Ethernet IP	Optional
Performance Features	
Sensorless Vector Control	Standard
Volts/Hertz Control	Standard
IR and Slip Compensation	Standard
Electronic Reversing	Standard
Dynamic Braking	Optional
DC Braking	Standard
PID Setpoint Controller	Programmable
Critical Speed Lockout	Standard
Current (Torque) Limit	Standard
Adjustable Acceleration/Deceleration	Standard
Linear or S Curve Accel/Decel	Standard
Jog at Preset Speed	Standard
Thread/Preset Speeds	7
Automatic Restart	Selectable
Coasting Motor Start	Standard
Coast or Ramp Stop Selection	Standard
Elapsed Time Meter	Optional
Carrier Frequency Adjustment	1 – 16 kHz
Standard Conditions for Application and Service	
Maximum Operating Ambient Temperature	0 – 50°C up to FR9 0 – 40°C FR10 and larger, consult factory for 50°C rating above FR9
Storage Temperature	-40 – 60°C
Humidity (Maximum), Non-condensing	95%
Altitude (Maximum without Derate)	3300 ft. (1000m)
Line Voltage Variation	+10/-15%
Line Frequency Variation	45 – 66 Hz
Efficiency	>95%
Power Factor (Displacement)	0.99

Table 40-359. Standard I/O Specifications

Description	Specification
6 – Digital Input Programmable	24V: “0” ≤ 10V, “1” ≥ 18V, R_i > 5 kΩ
2 – Analog Input Configurable w/Jumpers	Voltage: 0 – ±10V, R_i > 200 kΩ Current: 0 (4) – 20 mA, R_i = 250 kΩ
2 – Digital Output Programmable	Form C Relays 250V AC 2 Amp or 30V DC 2 Amp resistive
1 – Digital Output Programmable	Open collector 48V DC 50 mA
1 – Analog Output Programmable Configurable w/Jumper	0 – 20 mA, R_L max. 500 ohms 10 bits ±2%

Catalog Number Selection

Table 40-360. CPX9000 Enclosed NEMA Type 1 Drive Catalog Numbering System

C P X 100 1 4 A A _ _ _ _ _ _ _ _ _ _

Build options alphabetically and numerically.

Product Family
CPX = Clean Power 18-Pulse Enclosed Drives

Horsepower Rating		
025 = 25 hp	**100** = 100 hp	**350** = 350 hp
030 = 30 hp	**125** = 125 hp	**400** = 400 hp
040 = 40 hp	**150** = 150 hp	**500** = 500 hp
050 = 50 hp	**200** = 200 hp	**600** = 600 hp
060 = 60 hp	**250** = 250 hp	**700** = 700 hp
075 = 75 hp	**300** = 300 hp	**800** = 800 hp

Enclosure Rating
1 = NEMA Type 1
3 = NEMA Type 3R
6 = NEMA 12 Filtered

Voltage Rating
2 = 230V (208 – 240V)
4 = 480V
5 = 575V (575 – 600V)

Application — Torque/Braking ①
A = I_L/No Brake Chopper
B = I_L/Internal Brake Chopper
D = I_H/No Brake Chopper
E = I_H/Internal Brake Chopper

Enclosed Style
A = Enclosed Drive

	Enclosed Options ②③④	Type
K1	Door-Mounted Speed Potentiometer ⑤	Control
K2	Door-Mounted Speed Potentiometer with HOA Selector Switch ⑤	Control
K3	3 – 15 psig Follower	Control
K4	HAND/OFF/AUTO Switch (22 mm)	Control
K5	MANUAL/AUTO Reference Switch (22 mm)	Control
K6	START/STOP Pushbuttons (22 mm)	Control
KF	Bypass Test Switch for RA and RB	Addl. Bypass
KO	Standard Elapsed Time Meter	Control
L1	Power On and Fault Pilot Lights	Light
L2	Bypass Pilot Lights for RA, RB, Bypass Options	Addl. Bypass
LE	Red RUN Light	Light
P1	Input Disconnect	Input
PE	Output Contactor	Output
PF	Output Filter	Output
PG	MotoRx (Up to 600 Ft.) 1000 V/µS DV/DT Filter	Output
PH	Single Overload Relay	Output
PI	Dual Overload Relays	Output
PN	Dual Overloads for Bypass	Addl. Bypass
RA	Manual HOA Bypass Controller	Bypass
RB	Manual IOB Bypass Controller	Bypass
RC	Auto Transfer HOA Bypass Controller	Bypass
RD	Auto Transfer IOB Bypass Controller	Bypass
RG	Reduced Voltage Starter for Bypass	Bypass
S7	10" Expansion	Enclosure
S8	20" Expansion	Enclosure
S9	Space Heater	Enclosure

Communication Options ⑥	
C2 = Modbus	**CA** = Johnson Controls N2
C3 = Profibus DP	**CI** = Modbus TCP
C4 = LonWorks	**CJ** = BACnet
C5 = Profibus DP (D9 Connector)	**CK** = Ethernet IP
C6 = CanOpen (Slave)	**D3** = RS-232 with D9 Connection
C7 = DeviceNet	
C8 = Modbus (D9 Type Connector)	

Control Options
B1 = 6 DI, 1 ext +24V DC/EXT +24V DC
B2 = 1 RO (NC/NO), 1 RO (NO), 1 Therm
B4 = 1 AI (mA isolated), 2 AO (mA isolated), 1 ext +24V DC/EXT +24V DC
B5 = 3 RO (NO)
B8 = 1 ext +24V DC/EXT +24V DC, 3 Pt100
B9 = 1 RO (NO), 5 DI 42 – 240V AC Input

	Engineered Options
HT	High Temperature rating for 50°C (FR10 and above) ⑦
VB	Varnished Boards

① Brake Chopper is standard in drives up to 30 hp I_H or 40 hp I_L. It is optional in larger drives.
② Local/remote keypad is included as the standard Control Panel.
③ Some options are voltage and/or horsepower specific. Consult your Eaton representative for details.
④ See **Pages 40-251** and **40-252** for descriptions.
⑤ Includes local/remote speed reference switch.
⑥ See **Pages 40-253** and **40-254** for complete descriptions.
⑦ Consult Eaton for availability.

Product Selection



Figure 40-146. NEMA Type 1, 25 – 150 hp (30 x 90 x 21.5)

When Ordering

- Select a Base Catalog Number that meets the application requirements — nominal horsepower, voltage and enclosure rating. (The enclosed drive's continuous output amp rating should be equal to or greater than the motor's full load amp rating.) The base enclosed package includes a standard drive, door-mounted alphanumeric panel and enclosure.
- The CPX9000 product uses the term High Overload (I_H) in place of the term Constant Torque (CT). Likewise, Low Overload (I_L) is used in place of the term Variable Torque (VT). The new terms are a more precise description of the rating. The older terms included ambient temperature ratings in addition to overload ratings. In order to minimize enclosure size and offer the highest ambient temperature rating, overload and temperature ratings are now treated separately. Ambient temperature ratings are shown in **Table 40-361**. Consult the factory for 50°C ratings of FR10 and above.

Table 40-361. Ambient Temperature Ratings

Frame Size	I_H	I_L
FR4 – FR9	50°C	50°C
FR10 and above	40°C	40°C

- If Dynamic Brake Chopper or Control/Communication option is desired, change the appropriate code in the Base Catalog Number.
- **Note:** All of the programming is exactly the same as the standard SVX9000 drive.
- Select Enclosed Options. Add the codes as suffixes to the Base Catalog Number in alphabetical and numeric order.

480V Drives

Table 40-362. 480V AC CPX9000 Base Drive Product Selection

Enclosure Size ①	hp	Current (A)	Chassis Frame	NEMA Type 1		NEMA 12 Filtered		NEMA 3R ③	
				Base Catalog Number ②	Price U.S. $	Base Catalog Number ②	Price U.S. $	Base Catalog Number ②	Price U.S. $
Low Overload Drive									
7	25 30 40	38 46 61	FR6 FR6 FR6	**CPX02514BA** **CPX03014BA** **CPX04014BA**		**CPX02564BA** **CPX03064BA** **CPX04064BA**		**CPX02534AA** **CPX03034AA** **CPX04034AA**	
7	50 60 75	72 87 105	FR7 FR7 FR7	**CPX05014AA** **CPX06014AA** **CPX07514AA**		**CPX05064AA** **CPX06064AA** **CPX07564AA**		**CPX05034AA** **CPX06034AA** **CPX07534AA**	
7	100 125 150	140 170 205	FR8 FR8 FR8	**CPX10014AA** **CPX12514AA** **CPX15014AA**		**CPX10064AA** **CPX12564AA** **CPX15064AA**		**CPX10034AA** **CPX12534AA** **CPX15034AA**	
8	200 250	261 300	FR9 FR9	**CPX20014AA** **CPX25014AA**		**CPX20064AA** **CPX25064AA**		**CPX20034AA** **CPX25034AA**	
9	300 350 400	385 460 520	FR10 FR10 FR10	**CPX30014AA** **CPX35014AA** **CPX40014AA**		**CPX30064AA** **CPX35064AA** **CPX40064AA**		—	
10	500 550 600	590 650 730	FR11 FR11 FR11	**CPX50014AA** **CPX55014AA** **CPX60014AA**		**CPX50064AA** **CPX55064AA** **CPX60064AA**		—	
11	650 700 800	820 920 1030	FR11 FR12 FR12	**CPX65014AA** **CPX70014AA** **CPX80014AA**		**CPX65064AA** **CPX70064AA** **CPX80064AA**		—	
High Overload Drive									
7	25 30 40	38 46 61	FR6 FR6 FR7	**CPX02514EA** **CPX03014EA** **CPX04014DA**		**CPX02564EA** **CPX03064EA** **CPX04064DA**		**CPX02534DA** **CPX03034DA** **CPX04034DA**	
7	50 60 75	72 87 105	FR7 FR7 FR8	**CPX05014DA** **CPX06014DA** **CPX07514DA**		**CPX05064DA** **CPX06064DA** **CPX07564DA**		**CPX05034DA** **CPX06034DA** **CPX07534DA**	
7	100 125	140 170	FR8 FR8	**CPX10014DA** **CPX12514DA**		**CPX10064DA** **CPX12564DA**		**CPX10034DA** **CPX12534DA**	
8	150 200	205 245	FR9 FR9	**CPX15014DA** **CPX20014DA**		**CPX15064DA** **CPX20064DA**		**CPX15034DA** **CPX20034DA**	
9	250 300 350	300 385 460	FR10 FR10 FR10	**CPX25014DA** **CPX30014DA** **CPX35014DA**		**CPX25064DA** **CPX30064DA** **CPX35014DA**		—	
10	400 500 550	520 590 650	FR11 FR11 FR11	**CPX40014DA** **CPX50014DA** **CPX55014DA**		**CPX40064DA** **CPX50064DA** **CPX55064DA**		—	
11	600 650 700	720 820 840	FR12 FR12 FR12	**CPX60014DA** **CPX65014DA** **CPX70014DA**		**CPX60064DA** **CPX65064DA** **CPX70064DA**		—	

① See enclosure dimensions in **Table 40-364**.
② The 18-pulse Clean Power assembly includes a standard drive, door-mounted local/remote keypad and enclosure.
③ All NEMA 3R drives use the Box F Enclosure.

Discount Symbol **SS-3**

575V Drives

Table 40-363. 575V AC CPX9000 Base Drive Product Selection

Enclosure Size ①	hp	Current (A)	Chassis Frame	NEMA Type 1		NEMA 12 Filtered		NEMA 3R ③	
				Base Catalog Number ②	Price U.S. $	Base Catalog Number ②	Price U.S. $	Base Catalog Number ②	Price U.S. $
Low Overload Drive									
7	25 30	27 34	FR6 FR6	**CPX02515BA** **CPX03015BA**		**CPX02565BA** **CPX03065BA**		**CPX02535BA** **CPX03035BA**	
7	40 50	41 52	FR7 FR7	**CPX04015BA** **CPX05015AA**		**CPX04065BA** **CPX05065AA**		**CPX04035BA** **CPX05035AA**	
7	60 75 100	62 80 100	FR8 FR8 FR8	**CPX06015AA** **CPX07515AA** **CPX10015AA**		**CPX06065AA** **CPX07565AA** **CPX10065AA**		**CPX06035AA** **CPX07535AA** **CPX10035AA**	
8	125 150 200	125 144 208	FR9 FR9 FR9	**CPX12515AA** **CPX15015AA** **CPX20015AA**		**CPX12565AA** **CPX15065AA** **CPX20065AA**		**CPX12535AA** **CPX15035AA** **CPX20035AA**	
9	250 300 400	261 325 385	FR10 FR10 FR10	**CPX25015AA** **CPX30015AA** **CPX40015AA**		**CPX25065AA** **CPX30065AA** **CPX40065AA**		—	
10	500 600	502 590	FR11 FR11	**CPX50015AA** **CPX60015AA**		**CPX50065AA** **CPX60065AA**		—	
11	650 700 800	650 750 820	FR12 FR12 FR12	**CPX65015AA** **CPX70015AA** **CPX80015AA**		**CPX65065AA** **CPX70065AA** **CPX80065AA**		—	
High Overload Drive									
7	25	27	FR6	**CPX02515EA**		**CPX02565EA**		**CPX02535EA**	
7	30 40	34 41	FR7 FR7	**CPX03015EA** **CPX04015DA**		**CPX03065EA** **CPX04065DA**		**CPX03035EA** **CPX04035DA**	
7	50 60 75	52 62 80	FR8 FR8 FR8	**CPX05015DA** **CPX06015DA** **CPX07515DA**		**CPX05065DA** **CPX06065DA** **CPX07565DA**		**CPX05035DA** **CPX06035DA** **CPX07535DA**	
8	100 125 150	100 125 144	FR9 FR9 FR9	**CPX10015DA** **CPX12515DA** **CPX15015DA**		**CPX10065DA** **CPX12565DA** **CPX15065DA**		**CPX10035DA** **CPX12535DA** **CPX15035DA**	
9	200 250 300	208 261 325	FR10 FR10 FR10	**CPX20015DA** **CPX25015DA** **CPX30015DA**		**CPX20065DA** **CPX25065DA** **CPX30065DA**		—	
10	400 450 500	385 460 502	FR11 FR11 FR11	**CPX40015DA** **CPX45015DA** **CPX50015DA**		**CPX40065DA** **CPX45065DA** **CPX50065DA**		—	
11	600 650 700	590 650 750	FR12 FR12 FR12	**CPX60015DA** **CPX65015DA** **CPX70015DA**		**CPX60065DA** **CPX65065DA** **CPX70065DA**		—	

① See enclosure dimensions in **Table 40-364**.
② The 18-pulse Clean Power assembly includes a standard drive, door-mounted local/remote keypad and enclosure.
③ All NEMA 3R drives use the Box F Enclosure.

Table 40-364. CPX9000 Enclosure Dimensions

Enclosure Size ④	Approximate Dimensions in Inches (mm)			Approx. Shipping Weight in lbs (kg)
	Width	Height	Depth	
7	30.00 (762.0)	90.00 (2286.0)	21.50 (546.1)	1,000 (454)
8	48.00 (1219.2)	90.00 (2286.0)	26.14 (664.0)	1,400 (636)
9	60.00 (1524.0)	90.00 (2286.0)	25.74 (653.8)	1,800 (817)
10	80.00 (2032.0)	90.00 (2286.0)	31.75 (806.5)	2,100 (953)
11 ⑤⑥	120.00 (3048.0)	90.00 (2286.0)	25.74 (653.8)	2,500 (1,135)
Box F ⑦	60.00 (1524.0)	93.50 (2374.9)	37.50 (952.5)	2,500 (1,135)

④ Enclosure sizes accommodate drive and options, including bypass and disconnect. For other power options, consult your Eaton representative.
⑤ Consult factory. Limited power options available.
⑥ Enclosure size 11 consists of two of the enclosure size 9.
⑦ All NEMA 3R drives use the Box F Enclosure.

Discount Symbol SS-3

Options

Control/Communication Option Descriptions

Table 40-365. Available Control/Communications Options

Option	Description	Option Type
K1	**Door-Mounted Speed Potentiometer** — Provides the CPX9000 with the ability to adjust the frequency reference using a door-mounted potentiometer. This option uses the 10V DC reference to generate a 0 – 10V signal at the analog voltage input signal terminal. When the HOA bypass option is added, the speed is controlled when the HOA switch is in the hand position. Without the HOA bypass option, a 2-position switch (labeled local/remote) is provided on the keypad to select speed reference from the Speed Potentiometer or a remote speed signal.	Control
K2	**Door-Mounted Speed Potentiometer with HOA Selector Switch** — Provides the CPX9000 with the ability to start/stop and adjust the speed reference from door-mounted control devices or remotely from customer supplied inputs. In HAND position, the drive will start and the speed is controlled by the door-mounted speed potentiometer. The drive will be disabled in the OFF position. When AUTO is selected, the drive run and speed control commands are via user-supplied dry contact and 4 – 20 mA signal.	Control
K3	**3 – 15 psig Follower** — Provides a pneumatic transducer which converts a 3 – 15 psig pneumatic signal to either 0 – 8V DC or a 1 – 9V DC signal interface with the CPX9000. The circuit board is mounted on the inside of the front enclosure panel and connects to the user's pneumatic control system via 6 ft. (1.8m) of flexible tubing and a 1/4 inch (6.4 mm) brass tube union.	Control
K4	**HAND/OFF/AUTO Switch for Non-bypass Configurations** — Provides a three-position selector switch that allows the user to select either a Hand or Auto mode of operation. Hand mode is defaulted to keypad operation, and Auto mode is defaulted to control from an external terminal source. These modes of operation can be configured via drive programming to allow for alternate combinations of start and speed sources. Start and speed sources include Keypad, I/O and Fieldbus.	Control
K5	**MANUAL/AUTO Speed Reference Switch** — Provides door-mounted selector switch for Manual/Auto speed reference.	Control
K6	**START/STOP Pushbuttons** — Provides door-mounted START and STOP pushbuttons for either bypass or non-bypass configurations.	Control
KF	**Bypass Test Switch for RB and RA** — Allows the user to energize the AF drive for testing while operating the motor on the bypass controller. The Test Switch is mounted on the inside of the enclosure door.	Addl. Bypass
KO	**Standard Elapsed Time Meter** — Provides a door-mounted elapsed run time meter.	Control
L1	**Power On and Fault Power Lights** — Provides a white power on light that indicates power to the enclosed cabinet and a red fault light that indicates a drive fault has occurred.	Light
L2	**Bypass Pilot Lights for RB, RA Bypass Options** — A green light indicates when the motor is running in inverter mode and an amber light indicates when the motor is running in bypass mode. The lights are mounted on the enclosure door, above the switches.	Addl. Bypass
LE	**Red Run Pilot Light (22 mm)** — Provides a red run pilot light that indicates the drive is running.	Light
P1	**Input Circuit Breaker** — High Interrupting Circuit Breaker that provides a means of short circuit protection for the power cables between it and the CPX9000, and protection from high-level ground faults on the power cable. Allows a convenient means of disconnecting the CPX9000 from the line and the operating mechanism can be padlocked in the OFF position. This is factory mounted in the enclosure. Standard rating is 65 KAIC at 208/480V. 100 KAIC is available as an option.	Input
PE	**Output Contactor** — Provides a means for positive disconnection of the drive output from the motor terminals. The contactor coil is controlled by the drive's run or permissive logic. NC and NO auxiliary contacts rated at 10A, 600V AC are provided for customer use. Bypass Options **RB** and **RA** include an Output Contactor as standard. This option includes a low VA 115V AC fused Control Power Transformer and is factory mounted in the enclosure.	Output
PF	**Output Filter** — Used to reduce the transient voltage (DV/DT) at the motor terminals. The Output Filter is recommended for cable lengths exceeding 100 ft. (30m) with a drive of 3 hp and above, for cable lengths of 33 ft. (10m) with a drive of 2 hp and below, or for a drive rated at 525 – 690V. This option is mounted in the enclosure, and may be used in conjunction with a Brake Chopper Circuit.	Output
PG	**MotoRx (300 – 600 Ft.) 1000 V/µS DV/DT Filter** — Used to reduce transient voltage (DV/DT) and peak voltages at the motor terminals. This option is comprised of a 0.5% line reactor, followed by capacitive filtering and an energy recovery/clamping circuit. Unlike the Output Filter (See option **PF**), the MotoRx recovers most of the energy from the voltage peaks, resulting in a lower voltage drop to the motor, and therefore conserving power. This option is used when the distance between a single motor and the drive is 300 – 600 feet (91 – 183m).	Output
PH	**Single Overload Relay** — Uses a bimetallic overload relay to provide additional overload current protection to the motor on configurations without bypass options. It is included with the Bypass Configurations for overload current protection in the bypass mode. The Overload Relay is mounted within the enclosure, and is manually resettable. Heater pack included.	Output
PI	**Dual Overload Relays** — This option is recommended when a single drive is operating 2 motors and overload current protection is needed for each of the motors. The standard configuration includes two bimetallic overload relays, each sized to protect a motor with 50% of the drive hp rating. For example, a 100 hp drive would include two overload relays sized to protect two 50 hp motors. The relays are mounted within the enclosure, and are manually resettable. Heater packs not included.	Output
PN	**Dual Overloads for Bypass** — This option is recommended when a single drive is operating 2 motors in the bypass mode and overload current protection is needed for each of the motors. The standard configuration includes two bimetallic overload relays, each sized to protect a motor with 50% of the drive hp rating. For example, a 100 hp drive would include two overload relays sized to protect two 50 hp motors. The relays are mounted within the enclosure, and are manually resettable.	Addl. Bypass

Table 40-365. Available Control/Communications Options (Continued)

Option	Description	Option Type
RA	**Manual HOA Bypass Controller** — The Manual HAND/OFF/AUTO (HOA) — 3-contactor — bypass option provides a means of bypassing the CPX9000, allowing the AC motor to be operated at full speed directly from the AC supply line. This option consists of an input disconnect, a fused control power transformer, and a full voltage bypass starter with a door mounted HOA selector switch and an INVERTER/BYPASS switch. The HOA switch provides the ability to start and stop the drive in the inverter mode. For applications up to 250 hp, an ***IT.*** Series IEC input contactor, an ***IT.*** Series IEC output contactor, and an ***IT.*** Series IEC starter with an electronic overload relay is included. For applications above 250 hp, an Advantage input contactor, an Advantage output contactor and an Advantage starter with electronic overload protection is included. The contactors are mechanically and electrically interlocked (see power diagram on **Page 40-261**).	Bypass
RB	**Manual IOB Bypass Controller** — The Manual INVERTER/OFF/BYPASS (IOB) — 3-contactor — bypass option provides a means of bypassing the CPX9000, allowing the AC motor to be operated at full speed directly from the AC supply line. This option consists of an input disconnect, a fused control power transformer, and a full voltage bypass starter with a door mounted IOB selector switch. For applications up to 250 hp, an ***IT.*** Series IEC input contactor, an ***IT.*** Series IEC output contactor, and an ***IT.*** Series IEC starter with an electronic overload relay is included. For applications above 250 hp, an Advantage input contactor, an Advantage output contactor and an Advantage starter with electronic overload protection is included. The contactors are mechanically and electrically interlocked (see power diagram on **Page 40-261**).	Bypass
RC	**Auto Transfer HOA Bypass Controller** – The Manual HAND/OFF/AUTO (HOA) — 3-contactor — bypass option provides a means of bypassing the CPX9000, allowing the AC motor to be operated at full speed directly from the AC supply line. The circuitry provides an automatic transfer of the load to "across the line" operation after a drive trip. This option consists of an input disconnect, a fused control power transformer, and a full voltage bypass starter with a door mounted HOA selector switch and an INVERTER/BYPASS switch. The HOA switch provides the ability to start and stop the drive in either mode. For applications up to 250 hp, an ***IT.*** Series IEC input contactor, an ***IT.*** Series IEC output contactor, and an ***IT.*** Series IEC starter with an electronic overload relay is included. For applications above 250 hp, an Advantage input contactor, an Advantage output contactor and an Advantage starter with electronic overload protection is included. The contactors are mechanically and electrically interlocked (see power diagram on **Page 40-261**). Door mounted pilot lights are provided which indicate bypass or inverter operation. A green light indicates when the motor is running in inverter mode and an amber light indicates when the motor is running in bypass mode. **WARNING**: The motor may restart when the overcurrent relay is reset when operating in bypass, unless the IOB selector switch is turned to the OFF position.	Bypass
RD	**Auto Transfer IOB Bypass Controller** — The Auto INVERTER/OFF/BYPASS (IOB) — 3-contactor — bypass option provides a means of bypassing the CPX9000, allowing the AC motor to be operated at full speed directly from the AC supply line. The circuitry provides an automatic transfer of the load to "across the line" operation after a drive trip. This option consists of an input disconnect, a fused control power transformer, and a full voltage bypass starter with a door mounted IOB selector switch. For applications up to 250 hp, an ***IT.*** Series IEC input contactor, an ***IT.*** Series IEC output contactor, and an ***IT.*** Series IEC starter with an electronic overload relay is included. For applications above 250 hp, an Advantage input contactor, an Advantage output contactor and an Advantage starter with electronic overload protection is included. The contactors are mechanically and electrically interlocked (see power diagram on **Page 40-261**). Door mounted pilot lights are provided which indicate bypass or inverter operation. A green light indicates when the motor is running in inverter mode and an amber light indicates when the motor is running in bypass mode. **WARNING**: The motor may restart when the overcurrent relay is reset when operating in bypass, unless the IOB selector switch is turned to the OFF position.	Bypass
RG	**Reduced Voltage Starter for Bypass** — Used in conjunction with bypass option RA, RB, RC or RD. This option adds ***IT.*** Series reduced voltage soft starter to bypass assembly for soft starting in bypass mode.	Bypass
S7	**10" Expansion** — Expansion cabinet allows for special components, customer-supplied components or oversized cables. **NOTE:** Enclosure expansion rated NEMA Type 1 only.	Enclosure
S8	**20" Expansion** — Expansion cabinet allows for special components, customer-supplied components or oversized cables. **NOTE:** Enclosure expansion rated NEMA Type 1 only.	Enclosure
S9	**Space Heater** — Prevents condensation from forming in the enclosure when the drive is inactive or in storage. Includes a thermostat for variable temperature control. The 400W heater requires a customer supplied 115V remote supply source.	Enclosure

Note: For availability, see **Pages 40-254** and **Page 40-255** for base drive voltage required.

Table 40-366. Dissipated Watt Losses

Horsepower	40	50	60	75	100	125	150	200	250	300	350	400	450	500	600	700	800
Watts	1844	2170	2540	3040	4011	4940	5730	8020	9383	11600	13600	15700	16250	17976	20393	27200	31400

CPX9000 Series Option Board Kits

The CPX9000 Series drives can accommodate a wide selection of expander and adapter option boards to customize the drive for your application needs. The drive's control unit is designed to accept a total of five option boards (see **Figure 40-147**).

The CPX9000 Series factory installed standard board configuration includes an A9 I/O board and an A2 relay output board, which are installed in slots A and B.

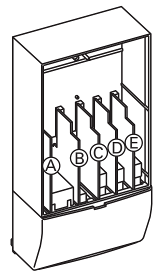


Figure 40-147. CPX9000 Series Option Boards

Table 40-367. Option Board Kits

Option Kit Description ②	Allowed Slot Locations ①	Field Installed		Factory Installed		SVX Ready Programs						
		Catalog Number	Price U.S.$	Option Designator	Adder U.S.$	Basic	Local/ Remote	Standard	MSS	PID	Multi-P.	PFC
Standard I/O Cards (See Figure 40-147)												
2 RO (NC/NO)	B	**OPTA2**		—		X	X	X	X	X	X	X
6 DI, 1 DO, 2 AI, 1AO, 1 +10V DC ref, 2 ext +24V DC/ EXT +24V DC	A	**OPTA9**		—		X	X	X	X	X	X	X
Extended I/O Card Options												
6 DI, 1 ext +24V DC/EXT +24V DC	B, C, **D**, E	**OPTB1**		**B1**		—	—	—	—	—	X	X
1 RO (NC/NO), 1 RO (NO), 1 Therm	B, C, **D**, E	**OPTB2**		**B2**		—	—	—	—	—	X	X
1 AI (mA isolated), 2 AO (mA isolated), 1 ext +24V DC/EXT +24V DC	B, C, **D**, E	**OPTB4**		**B4**		X	X	X	X	X	X	X
3 RO (NO)	B, C, **D**, E	**OPTB5**		**B5**		—	—	—	—	—	X	X
1 ext +24V DC/EXT +24V DC, 3 Pt100	B, C, **D**, E	**OPTB8**		**B8**		—	—	—	—	—	—	—
1 RO (NO), 5 DI 42 – 240V AC Input	B,C, **D**, E	**OPTB9**		**B9**		—	—	—	—	—	X	X
Communication Cards ③												
Modbus	D, **E**	**OPTC2**		**C2**		X	X	X	X	X	X	X
Modbus TCP	D, **E**	**OPTCI**		**CI**		X	X	X	X	X	X	X
BACnet	D, **E**	**OPTCJ**		**CJ**		X	X	X	X	X	X	X
Ethernet IP	D, **E**	**OPTCK**		**CK**		X	X	X	X	X	X	X
Johnson Controls N2	D, **E**	**OPTC2**		**CA**		—	—	—	—	—	—	—
Profibus DP	D, **E**	**OPTC3**		**C3**		X	X	X	X	X	X	X
LonWorks	D, **E**	**OPTC4**		**C4**		X	X	X	X	X	X	X
Profibus DP (D9 Connector)	D, **E**	**OPTC5**		**C5**		X	X	X	X	X	X	X
CanOpen (Slave)	D, **E**	**OPTC6**		**C6**		X	X	X	X	X	X	X
DeviceNet	D, **E**	**OPTC7**		**C7**		X	X	X	X	X	X	X
Modbus (D9 Type Connector)	D, **E**	**OPTC8**		**C8**		X	X	X	X	X	X	X
RS-232 with D9 Connection	D, **E**	**OPTD3**		**D3**		X	X	X	X	X	X	X

① Option card must be installed in one of the slots listed for that card. Slot indicated in Bold is the preferred location.
② AI = Analog Input; AO = Analog Output, DI = Digital Input, DO = Digital Output, RO = Relay Output
③ OPTC2 is a multi-protocol option card.

Modbus RTU Network Communications

The Modbus Network Card OPTC2 is used for connecting the 9000X Drive as a slave on a Modbus network. The interface is connected by a 9-pin DSUB connector (female) and the baud rate ranges from 300 to 19200 baud. Other communication parameters include an address range from 1 to 247; a parity of None, Odd or Even; and the stop bit is 1.

Profibus Network Communications

The Profibus Network Card OPTC3 is used for connecting the 9000X Drive as a slave on a Profibus-DP network. The interface is connected by a 9-pin DSUB connector (female). The baud rates range from 9.6K baud to 12M baud, and the addresses range from 1 to 127.

LonWorks Network Communications

The LonWorks Network Card OPTC4 is used for connecting the 9000X Drive on a LonWorks network. This interface uses Standard Network Variable Types (SNVT) as data types. The channel connection is achieved using a FTT-10A Free Topology transceiver via a single twisted transfer cable. The communication speed with LonWorks is 78 kBits/s.

Discount Symbol........................ **SS-3**

CanOpen (Slave) Communications

The CanOpen (Slave) Network Card OPTC6 is used for connecting the 9000X Drive to a host system. According to ISO11898 standard cables to be chosen for CAN bus should have a nominal impedance of 120Ω, and specific line delay of nominal 5 nS/m. 120Ω line termination resistors required for installation.

DeviceNet Network Communications

The DeviceNet Network Card OPTC7 is used for connecting the 9000X Drive on a DeviceNet Network. It includes a 5.08 mm pluggable connector. Transfer method is via CAN using a 2-wire twisted shielded cable with 2-wire bus power cable and drain. The baud rates used for communication include 125K baud, 250K baud and 500K baud.

Johnson Controls Metasys™ N2 Network Communications

The OPTC2 fieldbus board provides communication between the 9000X Drive and a Johnson Controls Metasys™ N2 network. With this connection, the drive can be controlled, monitored and programmed from the Metasys system. The N2 fieldbus is available as a factory installed option and as a field installable kit.

Modbus/TCP Network Communications

The Modbus/TCP Network Card OPTCI is used for connecting the 9000X Drive to Ethernet networks utilizing Modbus protocol. It includes an RJ-45 pluggable connector. This interface provides a selection of standard and custom register values to communicate drive parameters. The board supports 10 Mbps and 100 Mbps communication speeds. The IP address of the board is configurable over Ethernet using a supplied software tool.

BACnet Network Communications

The BACnet Network Card OPTCJ is used for connecting the 9000X Drive to BACnet networks. It includes a 5.08 mm pluggable connector. Data transfer is Master-Slave/Token Passing (MS/TP) RS-485. This interface uses a collection of 30 Binary Value Objects (BVOs) and 35 Analog Value Objects (AVOs) to communicate drive parameters. The card supports 9.6, 19.2 and 38.4 Kbaud communication speeds and supports network addresses 1 – 127.

Ethernet/IP Network Communications

The Ethernet/IP Network Card OPTCK is used for connecting the 9000X Drive to Ethernet/Industrial Protocol networks. It includes an RJ-45 pluggable connector. The interface uses CIP objects to communicate drive parameters (CIP is "Common Industrial Protocol", the same protocol used by DeviceNet). The board supports 10 Mbps and 100 Mbps communication speeds. The IP address of the board is configurable by Static, BOOTP and DHCP methods.

Table 40-368. I/O Specifications for the Control/Communication Options

Description	Specifications
Analog voltage, input	0 – ±10V, $R_i \geq 200$ kΩ
Analog current, input	0 (4) – 20 mA, $R_i = 250$Ω
Digital Input	24V: "0" ≤ 10V, "1" ≥ 18V, $R_i > 5$ kΩ
Aux. voltage	24V (±20%), max. 50 mA
Reference voltage	10V ±3%, max. 10 mA
Analog current, output Analog voltage, output	0 (4) – 20 mA, $R_L = 500$ kΩ, resolution 10 bit, accuracy ≤ ±2% 0 (2) – 10V, $R_L \geq 1$ kΩ, resolution 10 bit, accuracy ≤ ±2%
Relay output Max. switching voltage Max. switching load Max. continuous load	 300V DC, 250V AC 8A/24V DC, .4A/300V DC, 2 kVA/250V AC 2A rms
Thermistor input	$R_{trip} = 4.7$ kΩ

Table 40-369. Conformal (Varnished) Coating Adder — 208 – 240V, 380 – 500V ①

Chassis Frame	Delivery Code	Adder U.S. $	Chassis Frame	Delivery Code	Adder U.S. $
FR6 FR7 FR8	FP FP FP		FR9 FR10 FR11 FR12	FP FP FP FP	

① See catalog number description to order.

Enclosed Options

Table 40-370. 480V Light Options

Catalog Number Suffix ➡	Power On/Fault Pilot Lights (22 mm)	Red RUN Light (22 mm)
	L1	LE
hp	Adder U.S. $	Adder U.S. $
25 – 800		

Table 40-371. 480V Control Options

Catalog Number Suffix ➡	Door-Mounted Speed Potentiometer	Door-Mounted Speed Potentiometer with HOA Selector Switch	3 – 15 psig Follower	HAND/OFF/AUTO Switch (22 mm)	MANUAL/AUTO Ref Switch (22 mm)	START/STOP Pushbuttons (22 mm)	Standard Elapsed Time Meter
	K1	K2	K3	K4	K5	K6	KO
hp	Adder U.S. $	Adder U.S. $	Adder U.S. $	Adder U.S. $	Adder U.S. $	Adder U.S. $	Adder U.S. $
25 – 800							

Discount Symbol **SS-3**

Table 40-372. 480V Bypass Options ①

Catalog Number Suffix ➡	Bypass Test Switch for RA, RB, RC, RD	Bypass Pilot Lights for RA, RB Options	Dual Overloads for Bypass	Manual HOA Bypass Controller	Manual IOB Bypass Controller	Auto Transfer HOA Bypass Controller	Auto Transfer IOB Bypass Controller	Reduced Volt Starter for Bypass
	KF	L2	PN	RA	RB	RC	RD	RG
hp	Adder U.S. $	Adder U.S. $	Adder U.S. $	Adder U.S. $	Adder U.S. $	Adder U.S. $	Adder U.S. $	Adder U.S. $
25 30 40 50 60								
75 100 125 150 200								
250 300 350 400 500 550								
600 650 700 800								

① See **Pages 40-251** and **40-252** for details.

Table 40-373. 480V Enclosure Options

Catalog Number Suffix ➡	10" Expansion	20" Expansion	Space Heater ②
	S7	S8	S9
Enclosure Size	Adder U.S. $	Adder U.S.	Adder U.S. $
7 8 9 10			
11			

② Requires customer supplied 115V AC supply.

Table 40-374. 480V Power Options

Catalog Number Suffix ➡	Input	Output				
	Input Circuit Breaker (65 KAIC)	Output Contactor	Output Filter ③	MotoRx (300 – 600 Ft.) 1000 V/μS DV/DT Filter ③	Single Overload Relay ④	Dual Overload Relays ④
	P1	PE	PF	PG	PH	PI
hp	Adder U.S. $	Adder U.S. $	Adder U.S. $	Adder U.S. $	Adder U.S. $	Adder U.S. $
25 30 40 50 60						
75 100 125 150 200						
250 300 350 400 500 550						
600 650 700 800						

③ Output filter may be required whenever the distance from the drive to the motor exceeds 100 feet (30m). Refer to Application Notes for further details.
④ Heater packs not included.

Discount Symbol **SS-3**

Dimensions

Enclosure Size 7

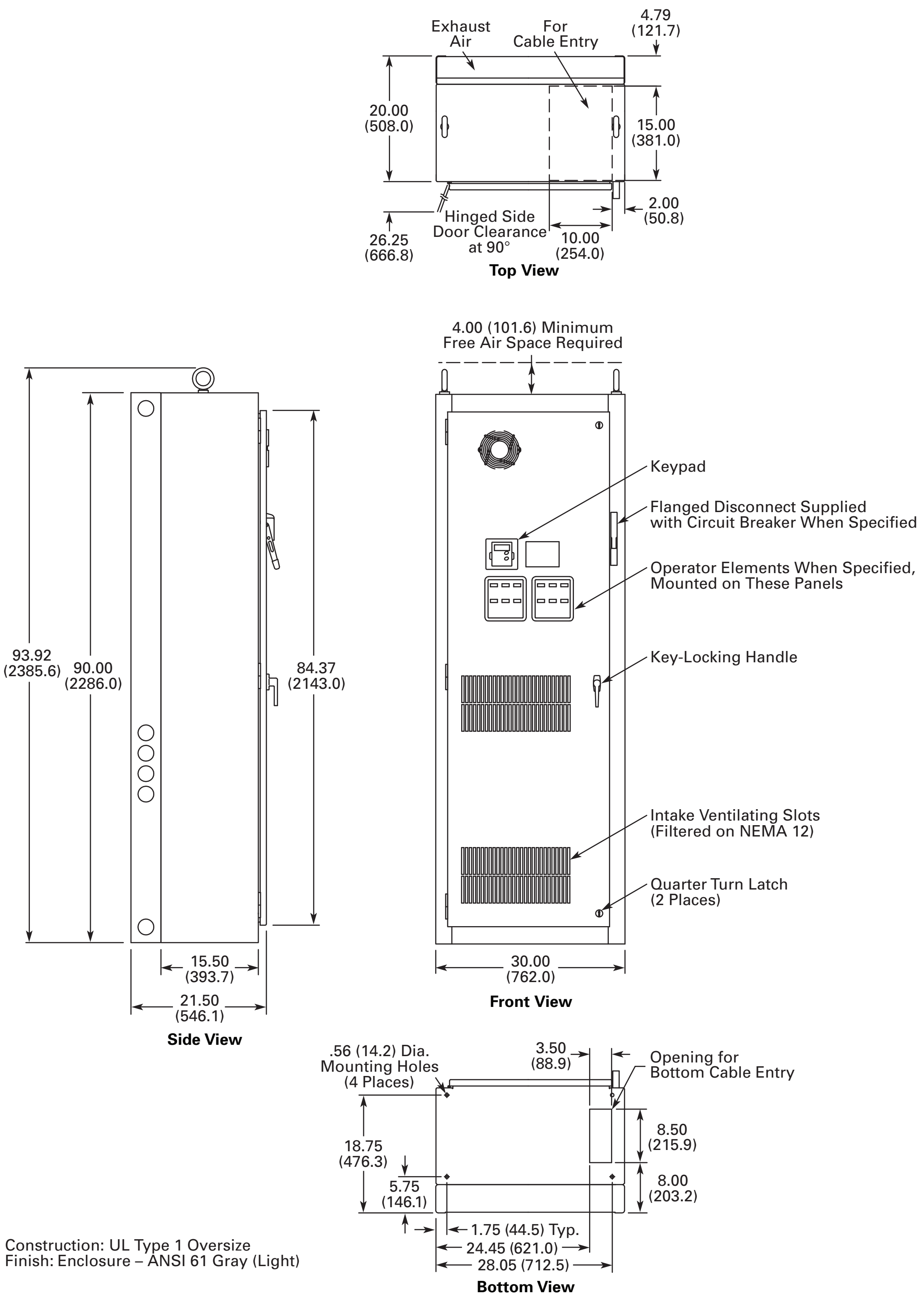


Figure 40-148. 25 – 150 hp I_L and 25 – 125 hp I_H 480V, 25 – 100 hp I_L and 25 – 75 hp I_H 575V — Approximate Dimensions in Inches (mm)

Enclosure Size 8

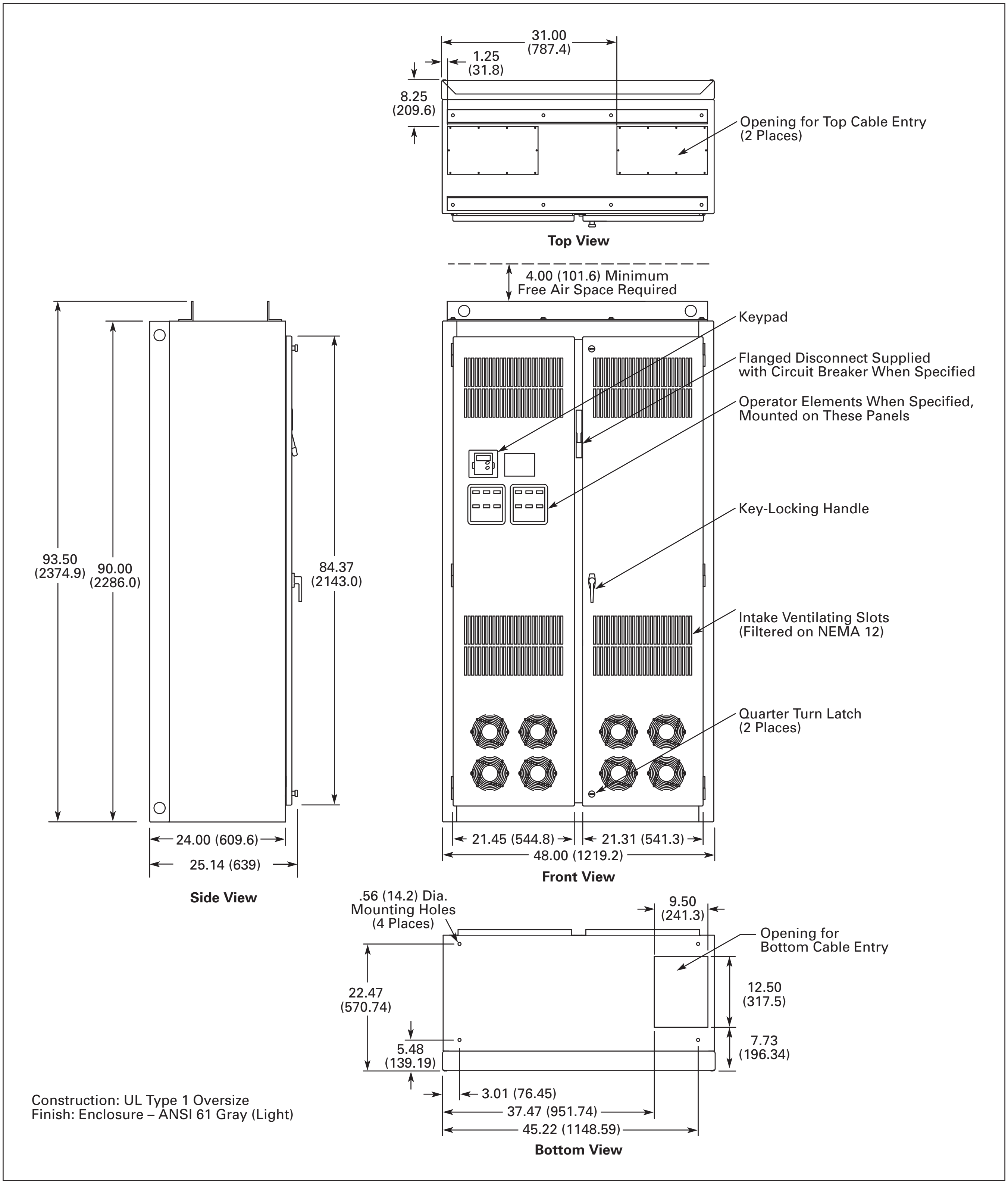


Figure 40-149. 200 – 250 hp I_L and 150 – 200 hp I_H 480V, 125 – 200 hp I_L and 100 – 150 hp I_H 575V — Approximate Dimensions in Inches (mm)

Enclosure Size 9

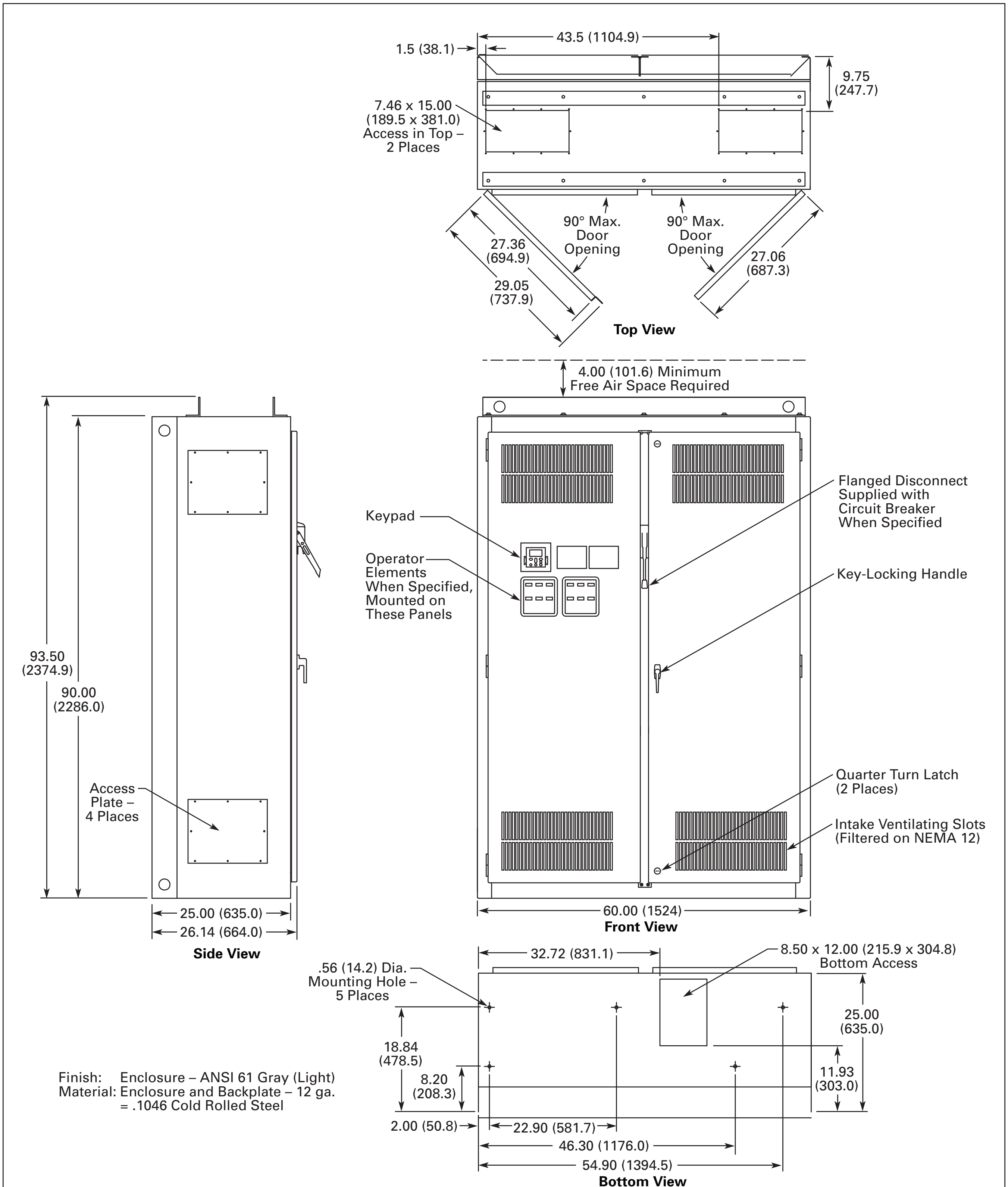


Figure 40-150. 300 – 400 hp I_L and 250 – 350 hp I_H 480V, 250 – 400 hp I_L and 200 – 300 hp I_H 575V — Approximate Dimensions in Inches (mm)

Enclosure Size 10

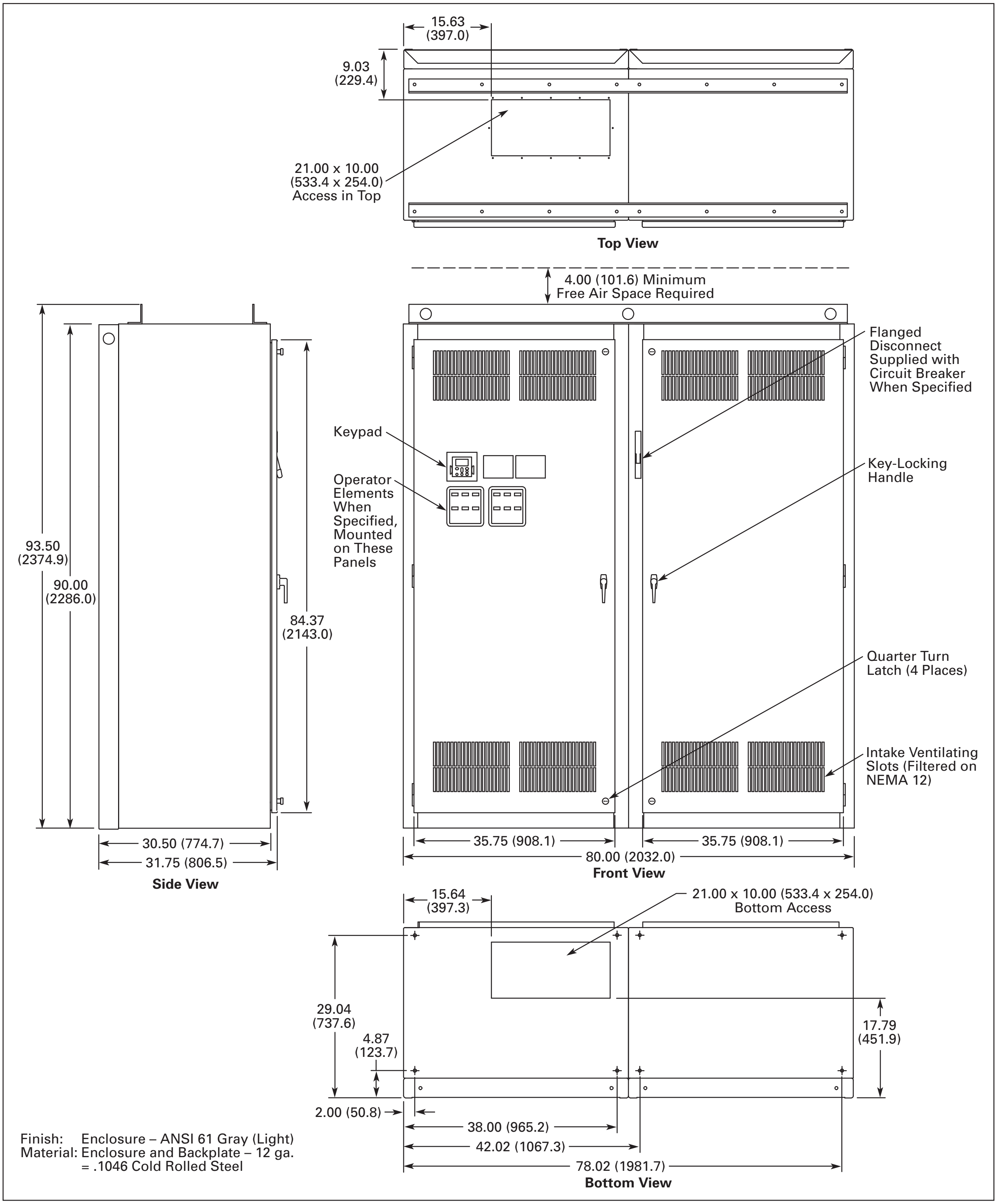


Figure 40-151. 500 – 600 hp I_L and 400 – 500 hp I_H 480V, 500 – 600 hp I_L and 400 – 500 hp I_H 575V — Approximate Dimensions in Inches (mm)

Enclosure Box F NEMA Type 3R Drives

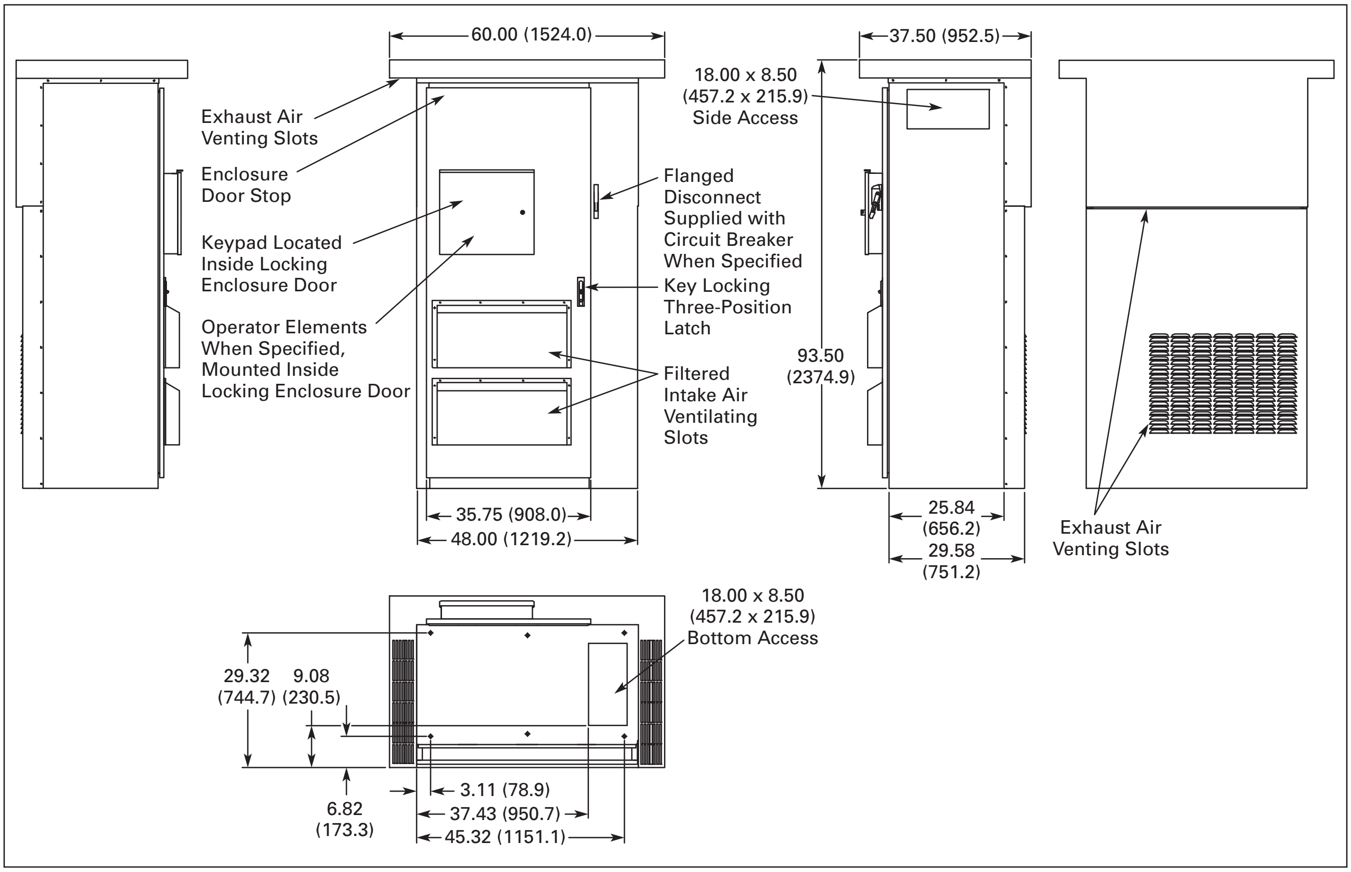


Figure 40-152. 25 – 250 hp I_L and 25 – 200 hp I_H 480V, 25 – 200 hp I_L and 25 – 150 hp I_H 575V NEMA 3R Drives — Approximate Dimensions in Inches (mm)

Wiring Diagrams

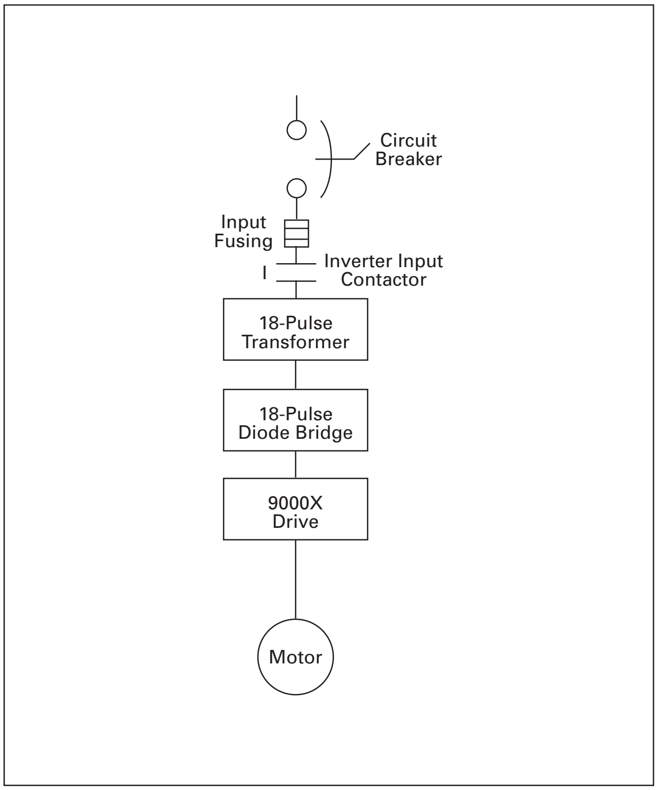


Figure 40-153. Power Diagram 25 – 250 hp I_L and 25 – 200 hp I_H

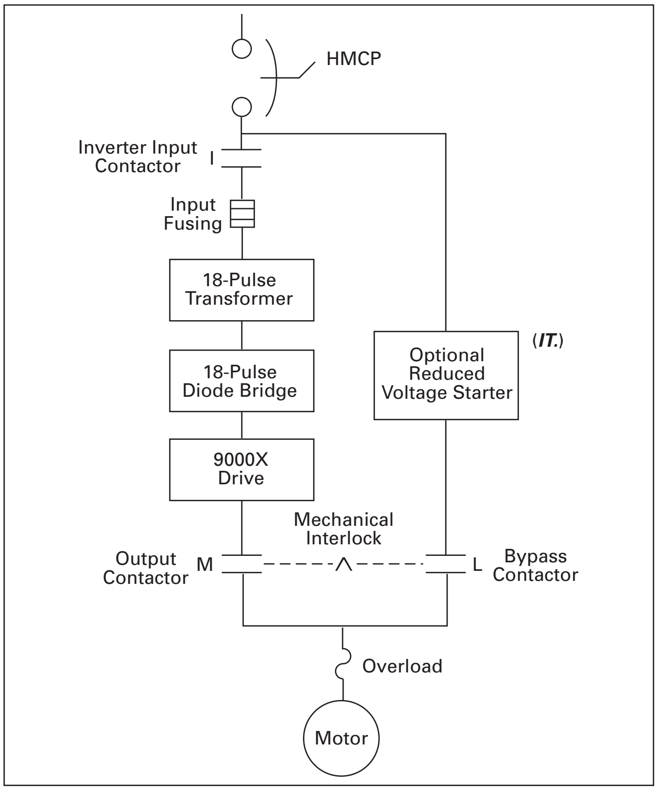


Figure 40-155. Power Diagram 25 – 250 hp I_L and 25 – 200 hp I_H with Bypass

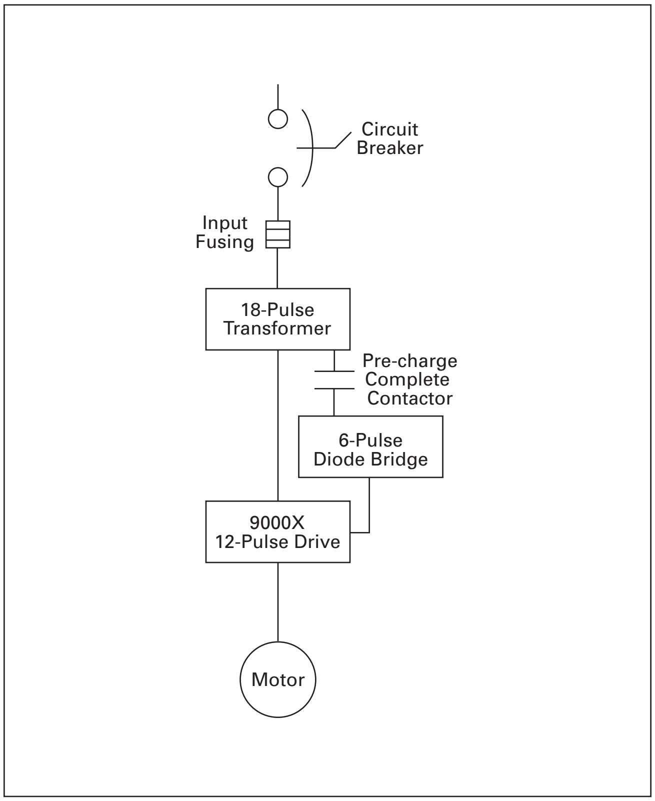


Figure 40-154. Power Diagram 300+ hp I_L and 250+ hp I_H

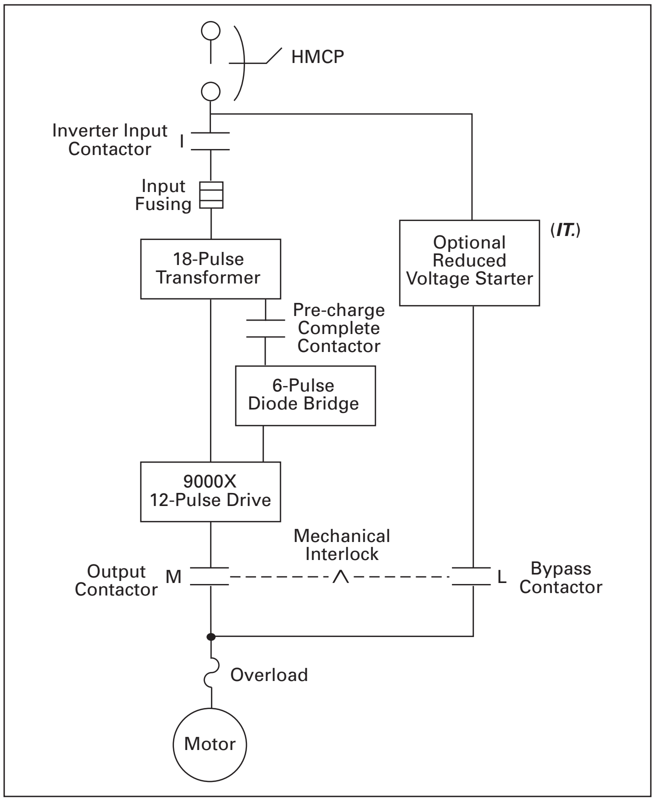


Figure 40-156. Power Diagram 300+ hp I_L/250+ hp I_H with Bypass

Contents





LCX9000 Liquid Cooled Drive

Product Description

The LCX9000 Liquid Cooled Drive family continues Eaton's tradition of providing state-of-the-industry Cutler-Hammer® products, by taking advantage of liquid cooling technology in lieu of air-cooling techniques.

The LCX9000 drives are liquid-cooled products that utilize potable water or a water-glycol mixture as a cooling medium.

Features and Benefits

- Compact size and low heat transfer rates allow enclosure size to be greatly reduced, which is especially beneficial in NEMA Type 4X applications
- Design is modular, with control and power modules independent of each other. Connection between power and control modules can be direct or extended via a fiber optic cable
- Same reliable control module and operating system as the SPX9000 air-cooled drives.
- CE mark ensures compliance with the Electromagnetic Compatibility Directive (EMC) and the Low Voltage Directive (LVD)
- Reliable drive with over 500,000 hours MTBF based on MIL 217
- Currently supports DeviceNet, PROFIBUS-DP, Modbus RTU and Modbus TCP communication protocols
- Separately mounted line reactor included with AC fed models

Technical Data and Specifications

Table 40-375. LCX9000 Specifications

Description	Specification
Line Voltage	400 – 500V AC; 525 – 690V AC; (-10% – 10%) 465 – 800V DC; 640 – 1100V DC; (-0 – 0%)
Frequency	50/60 Hz
Line Voltage Variation	-10% to 10%
Input Frequency Variation	45 – 66 Hz
Continuous Output Current	Rated current at incoming cooling liquid temperature of 30°C
Output Frequency	0 – 320 Hz
Drive Efficiency	> 95%
Power Factor (Displacement)	.96
Liquid Coolant Pressure	87 psi (6 bar) maximum
Liquid Coolant Flow Rate	1.3 to 7.9 gal./min. (5 to 30 liter/min.) minimum depending on drive size
Liquid Coolant Fittings	Standard quick connect, NPT
Operating Ambient Temperature	-10/+50°C
Storage Temperature	-40/+70°C
Humidity	95% maximum (non-condensing)
Altitude	3300 ft (1000 m) maximum without derating
Enclosure	IP00
Ratings	CE Mark
Warranty	Standard terms, 3 years with certified start-up

Table 40-376. Technical Information

Description	Specification
Mains Connection	
Input Voltage (V_{in})	400 – 500V AC; 525 – 690V AC; (-10% – 10%) 465 – 800V DC; 640 – 1100V DC; (-0 – 0%)
Input Frequency (f_{in})	45 – 66Hz
Connection to Mains	Once per minute or less (normal case)
Motor Connection	
Output Voltage	0 – V_{in}
Continuous Output Current	Rated current at nominal inflow cooling water temperature of 30°C; Overload 2 sec./20 sec.
Starting Current	Rated current at 2 sec./20 sec. if output frequency <30 Hz and temperature of heat-sink <149°F (65°C)
Output Frequency	0 – 320 Hz (standard); 7200 Hz (special software)
Frequency Resolution	Application dependent
Control Characteristics	
Control Method	Frequency control (V/f) Open loop: Sensorless vector control Closed loop: Frequency control Closed loop: Vector control
Switching Frequency (see parameter 2.6.9)	480V:Up to and including 61-Amp size: 1 – 16 kHz (factory default, 10 kHz) From 72-Amp size: 1 – 12 kHz (factory default, 3.6 kHz) 575V:1 – 6kHz (factory default, 1.5kHz) **Note: Derating required if higher switching frequency than the default is used.**
Frequency Reference	Analog input: Resolution .1% (10 bits); Accuracy ± 1% Panel reference: Resolution .01 Hz
Field Weakening Point	30 – 320 Hz
Acceleration Time	.1 – 3000 sec.
Deceleration Time	.1 – 3000 sec.
Braking Torque	DC brake: 30% x T_n (without brake option)
Ambient Conditions	
Ambient Operating Temperature	14°F (-10°C), no frost to +122°F (+50°C) at I_{th} 122 – 158°F (50 – 70°C), derating required
Storage Temperature	-40°F to +158°F (-40 to +70°C) No liquid in heatsink under 32°F (0°C)
Relative Humidity	5 – 96% RH, noncondensing, no dripping water
Air Quality	Chemical vapors: IEC 721-3-3, unit in operation, class 3C2 Mechanical particles: IEC 721-3-3, unit in operation, class 3S2 (no conductive dust allowed); No corrosive gases
Altitude	Up to 1,000m: 100% load capacity (no derating) Above 1,000m: Derating of 1% per each 100m required
Vibration	EN 50178, EN 60068-2-6; 5 – 150 Hz Displacement amplitude: .25 mm (peak) at 3 – 31 Hz Max. acceleration amplitude: 1G at 31 – 150 Hz
Shock	EN 50178, EN 60068-2-27, UPS drop test (for applicable UPS weights) Storage and shipping: Max. 15G, 11 mS (in package)
Enclosure Class	IP00 open frame standard in entire kW/hp range

Description	Specification
EMC	
Immunity	Fulfils all EMC immunity requirements
Emissions	EMC level N; EMC level T for IT networks
Safety	
Approvals	EN 50178, EN 60204-1, CE, UL, CUL, FI, GOST R, IEC 61800-5 (See unit nameplate for more detailed approvals.)
Control Connections	
Analog Input Voltage	0 to +10V, R_i = 200 kΩ (-10V to +10V joystick control) Resolution .1%; Accuracy ±1%
Analog Input Current	0(4) – 20 mA, R_i = 250Ω differential
Digital Inputs	6 positive or negative logic; 18 – 24V DC
Auxiliary Voltage	+24V, ±15%, max. 250 mA
Output Reference Voltage	+10V, +3%, max. load 10 mA
Analog Output	0(4) – 20 mA, R_L max. 500Ω Resolution 10 bits; Accuracy ±2%
Digital Outputs	Open collector output, 50 mA/48V
Relay Outputs	2 programmable change-over relay outputs Switching capacity: 24V DC/8A, 250V AC/8A, 125V DC/.4A Min. switching load: 5V/10 mA
Protections	
Overvoltage Protection Undervoltage Protection	**480V:** 911V; **575V:** 1200V **480V:** 333V; **575V:** 461V
Ground Fault Protection	In case of ground fault in motor or motor cable, only the drive is protected.
Mains Supervision	Trips if any of the input phases are missing (drives only).
Motor Phase Supervision	Trips if any of the output phases are missing
Unit Overtemperature Protection	Alarm limit: 149°F (65°C) for heatsink, 158°F (70°C) for circuit boards Trip limit: 158°F (70°C) for heatsink, 185°F (85°C) for circuit boards
Overcurrent Protection	Yes
Motor Overload Protection	Yes
Motor Stall Protection	Yes
Motor Underload Protection	Yes
Short-Circuit Protection	Yes (+24V and +10V reference voltages)
Liquid Cooling	
Allowed Cooling Agents	Drinking water Water-glycol mixture
Temperature of Cooling Agent	32 – 86°F (0 – 30°C) at I_{th} for input; 86 – 149°F (30 – 65°C) Max. temperature rise during circulation: 9°F (5°C), no condensation allowed
System Max. Working Pressure	87 psi (6 bar)
System Max. Peak Pressure	580 psi (40 bar)
Pressure Loss (at nominal flow)	Varies according to size

Catalog Number Selection

Table 40-377. LCX9000 Liquid Cooled Adjustable Frequency Drive Catalog Numbering System

L C X 0 1 6 A 0 – 4 A 2 B 1 _ _ _ _ _ _

Product Family

LCX = High Performance, Liquid-Cooled Drive

Current Rating

480V			
016 =	16A	**385** =	385A
022 =	22A	**460** =	460A
031 =	31A	**520** =	520A
038 =	38A	**590** =	590A
045 =	45A	**650** =	650A
061 =	61A	**730** =	730A
072 =	72A	**820** =	820A
087 =	87A	**920** =	920A
105 =	105A	**H10** =	1030A
140 =	140A	**H11** =	1150A
168 =	168A	**H13** =	1370A
205 =	205A	**H16** =	1640A
261 =	261A	**H20** =	2060A
300 =	300A	**H23** =	2300A

690V			
170 =	170A	**590** =	590A
208 =	208A	**650** =	650A
261 =	261A	**750** =	750A
325 =	325A	**820** =	820A
385 =	385A	**H10** =	1030A
416 =	416A	**H11** =	1180A
460 =	460A	**H13** =	1300A
502 =	502A	**H15** =	1500A

Software Series

A = Standard

Enclosure Rating

0 = Open Chassis

Voltage Rating

4 = 380 – 500V
5 = 520 – 690V

Keypad

A = Alphanumeric

Input Options

2 = 3-Phase, EMC N
7 = DC Input

Brake Chopper Options ①

N = No Brake Chopper Circuit
B = Internal Brake Chopper

Board Modifications

1 = Standard Boards
2 = Varnished Boards

Options

List options in alphabetical order.

Extended I/O Card Options

A3 = 2 RO, Therm
A4 = Encoder Low Volt +5V/15V/24V
A5 = Encoder High Volt +15V/24V
A7 = Dual Encoder +15V/24V
A8 = 6 DI, 1 DO, 2 AI, 1AO
AE = Encoder with 2 DOs
B1 = 6 DI, 1 ext +24V DC/EXT +24V DC
B2 = 1 RO (NC/NO), 1 RO (NO), 1 Therm
B4 = 1 AI (mA isolated), 2 AO (mA isolated), 1 ext +24V DC/EXT + 24V DC
B5 = 3 RO (NO)
B8 = 1 ext +24V DC/EXT +24V DC, 3 Pt100
B9 = 1 RO (NO), 5 DI 42 – 240V AC Input
BB = SPI, Absolute Encoder

Communication Cards

CA = Johnson Controls N2
CI = Modbus TCP
C2 = Modbus
C3 = Profibus DP
C4 = LonWorks
C5 = Profibus DP (D9 Connector)
C6 = CANopen (Slave)
C7 = DeviceNet
C8 = Modbus (D9 Type Connector)
D1 = Adapter
D2 = Adapter
D3 = RS-232 with D9 Connection

① Brake Chopper is only available in 480V CH3 Drives.

Product Selection

Table 40-378. 380 – 500V AC Liquid Cooled Drive Product Selection

Motor Output				Chassis	Catalog Number	Price U.S. $
Current			kW			
Thermal, I_{th} (A)	I_L (A)	I_H (A)				
16	15	11	7.5	CH3	**LCX016A0-4A2B1**	
22	20	15	11	CH3	**LCX022A0-4A2B1**	
31	28	21	15	CH3	**LCX031A0-4A2B1**	
38	35	25	18.5	CH3	**LCX038A0-4A2B1**	
45	41	30	22	CH3	**LCX045A0-4A2B1**	
61	55	41	30	CH3	**LCX061A0-4A2B1**	
72	65	48	37	CH4	**LCX072A0-4A2N1**	
87	79	58	45	CH4	**LCX087A0-4A2N1**	
105	95	70	55	CH4	**LCX105A0-4A2N1**	
140	127	93	75	CH4	**LCX140A0-4A2N1**	
168	153	112	90	CH5	**LCX168A0-4A2N1**	
205	186	137	110	CH5	**LCX205A0-4A2N1**	
261	237	174	132	CH5	**LCX261A0-4A2N1**	
300	273	200	160	CH61	**LCX300A0-4A2N1**	
385	350	257	200	CH61	**LCX385A0-4A2N1**	
460	418	307	250	CH72	**LCX460A0-4A2N1**	
520	473	347	250	CH72	**LCX520A0-4A2N1**	
590	536	393	315	CH72	**LCX590A0-4A2N1**	
650	591	433	355	CH72	**LCX650A0-4A2N1**	
730	664	487	400	CH72	**LCX730A0-4A2N1**	
820	745	547	450	CH63	**LCX820A0-4A2N1**	
920	836	613	500	CH63	**LCX920A0-4A2N1**	
1030	936	687	560	CH63	**LCXH10A0-4A2N1**	
1150	1045	766	600	CH63	**LCXH11A0-4A2N1**	
1370	1245	913	700	CH74	**LCXH13A0-4A2N1**	
1640	1491	1093	900	CH74	**LCXH16A0-4A2N1**	
2060	1873	1373	1100	CH74	**LCXH20A0-4A2N1**	
2300	2091	1533	1200	CH74	**LCXH23A0-4A2N1**	

Table 40-379. 525 – 690V AC Liquid Cooled Drive Product Selection

Motor Output				Chassis	Catalog Number	Price U.S. $
Current			kW			
Thermal, I_{th} (A)	I_L (A)	I_H (A)				
170	155	113	110	CH61	**LCX170A0-5A2N1**	
208	189	139	132	CH61	**LCX208A0-5A2N1**	
261	237	174	160	CH72	**LCX261A0-5A2N1**	
325	295	217	200	CH72	**LCX325A0-5A2N1**	
385	350	257	250	CH72	**LCX385A0-5A2N1**	
416	378	277	250	CH72	**LCX416A0-5A2N1**	
460	418	307	300	CH72	**LCX460A0-5A2N1**	
502	456	335	355	CH72	**LCX502A0-5A2N1**	
590	536	393	400	CH63	**LCX590A0-5A2N1**	
650	591	433	450	CH63	**LCX650A0-5A2N1**	
750	682	500	500	CH63	**LCX750A0-5A2N1**	
820	745	547	560	CH74	**LCX820A0-5A2N1**	
920	836	613	650	CH74	**LCX920A0-5A2N1**	
1030	936	687	700	CH74	**LCXH10A0-5A2N1**	
1180	1073	787	800	CH74	**LCXH11A0-5A2N1**	
1300	1182	867	900	CH74	**LCXH13A0-5A2N1**	
1500	1364	1000	1000	CH74	**LCXH15A0-5A2N1**	

Discount Symbol **SS-2**

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June 2008

Table 40-380. 540 – 675V DC Liquid Cooled Inverter Unit Product Selection

Drive Output					Power Loss c/a/T (kW)	Chassis	Catalog Number	Price U.S. $
Current			Motor Output Power					
Thermal I_{th} (A)	Rated Cont. I_L (A)	Rated Cont. I_H (A)	Optimum Motor at I_{th} 400V (kW)	Optimum Motor at I_{th} 500V (kW)				
16	15	11	7.5	11	0.4/0.2/**0.6**	CH3	**LCX016A0-4A7B1**	
22	20	15	11	15	0.5/0.2/**0.7**	CH3	**LCX022A0-4A7B1**	
31	28	21	15	18.5	0.7/0.2/**0.9**	CH3	**LCX031A0-4A7B1**	
38	35	25	18.5	22	0.8/0.2/**1.0**	CH3	**LCX038A0-4A7B1**	
45	41	30	22	30	1.0/0.3/**1.3**	CH3	**LCX045A0-4A7B1**	
61	55	41	30	37	1.3/0.3/**1.5**	CH3	**LCX061A0-4A7B1**	
72	65	48	37	45	1.2/0.3/**1.5**	CH4	**LCX072A0-4A7N1**	
87	79	58	45	55	1.5/0.3/**1.8**	CH4	**LCX087A0-4A7N1**	
105	95	70	55	75	1.8/0.3/**2.1**	CH4	**LCX105A0-4A7N1**	
140	127	93	75	90	2.3/0.3/**2.6**	CH4	**LCX140A0-4A7N1**	
168	153	112	90	110	2.5/0.3/**2.8**	CH5	**LCX168A0-4A7N1**	
205	186	137	110	132	3.0/0.4/**3.4**	CH5	**LCX205A0-4A7N1**	
261	237	174	132	160	4.0/0.4/**4.4**	CH5	**LCX261A0-4A7N1**	
300	273	200	160	200	4.5/0.4/**4.9**	CH61	**LCX300A0-4A7N1**	
385	350	257	200	250	5.5/0.5/**6.0**	CH61	**LCX385A0-4A7N1**	
460	418	307	250	315	5.5/0.5/**6.0**	CH62	**LCX460A0-4A7N1**	
520	473	347	250	355	6.5/0.5/**7.0**	CH62	**LCX520A0-4A7N1**	
590	536	393	315	400	7.5/0.6/**8.1**	CH62	**LCX590A0-4A7N1**	
650	591	433	355	450	8.5/0.6/**9.1**	CH62	**LCX650A0-4A7N1**	
730	664	487	400	500	10.0/0.7/**10.7**	CH62	**LCX730A0-4A7N1**	
820	745	547	450	560	12.5/0.8/**13.3**	CH63	**LCX820A0-4A7N1**	
920	836	613	500	600	14.4/0.9/**15.3**	CH63	**LCX920A0-4A7N1**	
1030	936	687	560	700	16.5/1.0/**17.5**	CH63	**LCXH10A0-4A7N1**	
1150	1045	766	600	750	18.4/1.1/**19.5**	CH63	**LCXH11A0-4A7N1**	
1370	1245	913	700	900	15.5/1.0/**16.5**	CH64	**LCXH13A0-4A7N1**	
1640	1491	1093	900	1100	19.5/1.2/**20.7**	CH64	**LCXH16A0-4A7N1**	
2060	1873	1373	1100	1400	26.5/1.5/**28.0**	CH64	**LCXH20A0-4A7N1**	
2300	2091	1533	1250	1500	29.6/1.7/**31.3**	CH64	**LCXH23A0-4A7N1**	
2470	2245	1647	1300	1600	36.0/2.0/**38.0**	2*CH64	**LCXH24A0-4A7N1**	
2950	2681	1967	1550	1950	39.0/2.4/**41.4**	2*CH64	**LCXH29A0-4A7N1**	
3710	3372	2473	1950	2450	48.0/2.7/**50.7**	2*CH64	**LCXH37A0-4A7N1**	
4140	3763	2760	2150	2700	53.0/3.0/**66.0**	2*CH64	**LCXH41A0-4A7N1**	

Table 40-381. 710 – 930V DC Liquid Cooled Inverter Unit Product Selection

Drive Output					Power Loss c/a/T (kW)	Chassis	Catalog Number	Price U.S. $
Current			Motor Output Power					
Thermal I_{th} (A)	Rated Cont. I_L (A)	Rated Cont. I_H (A)	Optimum Motor at I_{th} 400V (kW)	Optimum Motor at I_{th} 500V (kW)				
170	155	113	110	160	4.5/0.2/**4.7**	CH61	**LCX170A0-5A7N1**	
208	189	139	132	200	5.5/0.3/**5.8**	CH61	**LCX208A0-5A7N1**	
261	237	174	160	250	5.5/0.3/**5.8**	CH61	**LCX261A0-5A7N1**	
325	295	217	200	300	6.5/0.3/**6.8**	CH62	**LCX325A0-5A7N1**	
385	350	257	250	355	7.5/0.4/**7.9**	CH62	**LCX385A0-5A7N1**	
416	378	277	250	355	8.0/0.4/**8.4**	CH62	**LCX416A0-5A7N1**	
460	418	307	300	400	8.5/0.4/**8.9**	CH62	**LCX460A0-5A7N1**	
502	456	335	355	450	10.0/0.5/**10.5**	CH62	**LCX502A0-5A7N1**	
590	536	393	400	560	10.0/0.5/**10.5**	CH63	**LCX590A0-5A7N1**	
650	591	433	450	600	13.5/0.7/**14.2**	CH63	**LCX650A0-5A7N1**	
750	682	500	500	700	16.0/0.8/**16.8**	CH63	**LCX750A0-5A7N1**	
820	745	547	560	800	16.0/0.8/**16.8**	CH64	**LCX820A0-5A7N1**	
920	836	613	650	850	18.0/0.9/**18.9**	CH64	**LCX920A0-5A7N1**	
1030	936	687	700	1000	19.0/1.0/**20.0**	CH64	**LCXH10A0-5A7N1**	
1180	1073	787	800	1100	21.0/1.1/**22.1**	CH64	**LCXH11A0-5A7N1**	
1300	1182	867	900	1200	27.0/1.4/**28.4**	CH64	**LCXH13A0-5A7N1**	
1500	1364	1000	1050	1400	32.0/1.6/**33.6**	CH64	**LCXH15A0-5A7N1**	
1700	1545	1133	1150	1550	NA	CH64	**LCXH17A0-5A7N1**	
1850	1682	1233	1250	1650	34.2/1.8/**36.0**	2*CH64	**LCXH18A0-5A7N1**	
2120	1927	1413	1450	1900	37.8/2.0/**39.8**	2*CH64	**LCXH21A0-5A7N1**	
2340	2127	1560	1600	2100	48.6/2.5/**51.1**	2*CH64	**LCXH23A0-5A7N1**	
2700	2455	1800	1850	2450	57.6/3.0/**60.6**	2*CH64	**LCXH27A0-5A7N1**	
3100	2818	2066	2150	2800	NA	2*CH64	**LCXH31A0-5A7N1**	

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Discount Symbol **SS-2**

Series Option Board Kits

The 9000X Series drives can accommodate a wide selection of expander and adapter option boards to customize the drive for your application needs. The drive's control unit is designed to accept a total of five option boards (see **Figure 40-157**).

The 9000X Series factory installed standard board configuration includes an A9 I/O board and an A2 relay output board, which are installed in slots A and B.

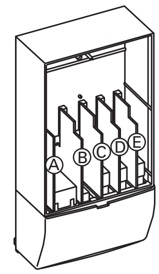


Figure 40-157. 9000X Series Option Boards

Table 40-382. Option Board Kits

Option Kit Description ②	Allowed Slot Locations ①	Field Installed		Factory Installed		SVX Ready Programs						
		Catalog Number	Price U.S.$	Option Designator	Adder U.S.$	Basic	Local/ Remote	Standard	MSS	PID	Multi-P.	PFC
Standard I/O Cards (See Figure 40-157)												
2 RO (NC/NO)	B	**OPTA2**		—		X	X	X	X	X	X	X
6 DI, 1 DO, 2 AI, 1AO, 1 +10V DC ref, 2 ext +24V DC/ EXT +24V DC	A	**OPTA9**		—		X	X	X	X	X	X	X
Extended I/O Card Options												
2 RO, Therm	B	**OPTA3**		**A3**		—	X	X	X	X	X	X
Encoder Low Volt +5V/15V/24V	C	**OPTA4**		**A4**		—	X	X	X	X	X	X
Encoder High Volt +15V/24V	C	**OPTA5**		**A5**		—	X	X	X	X	X	X
Dual Encoder +15V/24V	C	**OPTA7**		**A7**		—	X	X	X	X	X	X
6 DI, 1 DO, 2 AI, 1 AO	A	**OPTA8**		**A8**		—	X	X	X	X	X	X
3 DI (Encoder 10 – 24V), Out +15V/+24V, 2 DO (pulse+direction) — SPX Only	C	**OPTAE**		**AE**		X	X	X	X	X	X	X
6 DI, 1 ext +24V DC/EXT +24V DC	B, C, **D**, E	**OPTB1**		**B1**		—	—	—	—	—	X	X
1 RO (NC/NO), 1 RO (NO), 1 Therm	B, C, **D**, E	**OPTB2**		**B2**		—	—	—	—	—	X	X
1 AI (mA isolated), 2 AO (mA isolated), 1 ext +24V DC/EXT +24V DC	B, C, **D**, E	**OPTB4**		**B4**		—	X	X	X	X	X	X
3 RO (NO)	B, C, **D**, E	**OPTB5**		**B5**		—	—	—	—	—	X	X
1 ext +24V DC/EXT +24V DC, 3 Pt100	B, C, **D**, E	**OPTB8**		**B8**		—	—	—	—	—	—	—
1 RO (NO), 5 DI 42 – 240V AC Input	B,C, **D**, E	**OPTB9**		**B9**		—	—	—	—	—	X	X
SPI, Absolute Encoder	C	**OPTBB**		**BB**		—	—	—	—	—	—	—
Communication Cards												
Modbus	D, **E**	**OPTC2** ③		**C2**		X	X	X	X	X	X	X
Johnson Controls N2	D, **E**	**OPTC2** ③		**CA**		—	—	—	—	—	—	—
Profibus DP	D, **E**	**OPTC3**		**C3**		X	X	X	X	X	X	X
LonWorks	D, **E**	**OPTC4**		**C4**		X	X	X	X	X	X	X
Profibus DP (D9 Connector)	D, **E**	**OPTC5**		**C5**		X	X	X	X	X	X	X
CanOpen (Slave)	D, **E**	**OPTC6**		**C6**		X	X	X	X	X	X	X
DeviceNet	D, **E**	**OPTC7**		**C7**		X	X	X	X	X	X	X
Modbus (D9 Type Connector)	D, **E**	**OPTC8**		**C8**		X	X	X	X	X	X	X
Modbus TCP	D, **E**	**OPTCI**		**CI**		X	X	X	X	X	X	X
Adapter — SPX Only	D, **E**	**OPTD1**		**D1**		X	X	X	X	X	X	X
Adapter — SPX Only	D, **E**	**OPTD2**		**D2**		X	X	X	X	X	X	X
RS-232 with D9 Connection	D, **E**	**OPTD3**		**D3**		X	X	X	X	X	X	X
Keypad												
9000X Series Standard Keypad	—	**KEYPAD-STD**		—		—	—	—	—	—	—	X
9000X Series Remote Mount Keypad Unit (Keypad not included, includes 10 ft. cable, keypad holder, mounting hardware)	—	**OPTRMT-KIT-9000X**		—		—	—	—	—	—	—	—

① Option card must be installed in one of the slots listed for that card. Slot indicated in Bold is the preferred location.
② AI = Analog Input; AO = Analog Output, DI = Digital Input, DO = Digital Output, RO = Relay Output
③ OPTC2 is a multi-protocol option card.

Discount Symbol **SS-2**

Line Reactors

The line reactor carries out several functions in the Liquid Cooled Drive. Connection of the line reactor is necessary except if you have a component in your system that performs the same tasks (e.g. a transformer). The line reactor is needed as an essential component for motor control, to protect the input and DC-link components against abrupt changes of current and voltage as well as to function as a protection against harmonics. The line reactors are included in the standard delivery of liquid-cooled drives (not inverters). However, you can also order your drive without a line reactor.

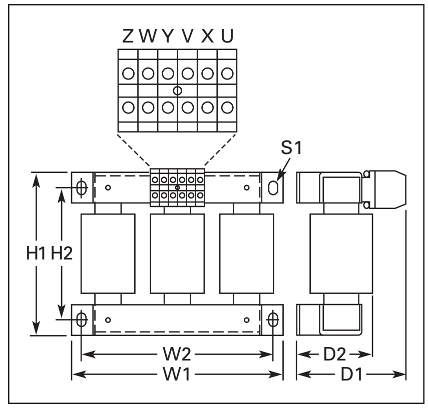


Figure 40-158. Line Reactor Dimensions for LCX9000 Drives Sizes up to 61A

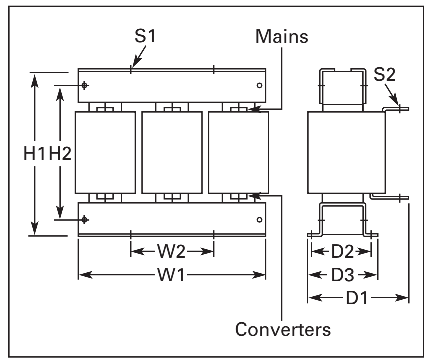


Figure 40-159. Line Reactor Dimensions for LCX9000 Drives Sizes larger than 61A

Table 40-383. Line Reactor Specifications

Drive Rating 480V	Drive Rating 690V	Thermal Current (A)	Nominal Inductance (µH) A/B ①	Calculated Loss (W)	Choke Catalog Number (690V AC)
16 to 22A	12 to 23A	23	1900	145	**CHK0023N6A0**
31 to 38A	31 to 38A	38	1100	170	**CHK0038N6A0**
45 to 61A	46 to 62A	62	700	210	**CHK0062N6A0**
72 to 87A	72 to 87A	87	480	250	**CHK0087N6A0**
105 to 140A	105 to 140A	145	290	380	**CHK0145N6A0**
168 to 261A	170 to 261A	261	139/187	460	**CHK0261N6A0**
300 to 385A	325 to 385A 820 to 1180A ②	400	90/126	570	**CHK0400N6A0**
460 to 520A 1370A ②	416 to 502A 1300 to 1500A ②	520	65/95	610	**CHK0520N6A0**
590 to 650A 1640A ②	590 to 650A	650	51/71	840	**CHK0650N6A0**
730A 2060A ②	—	730	45/61	850	**CHK0730N6A0**
820A 2300A ②	750A	N/A	N/A	N/A	**CHK0820N6A0**
920 to 1030A	—	1000	30/41	950	**CHK1030N6A0**
1150A	—	1150	26/36	1000	**CHK1150N6A0**

① Inductances for different supply voltages: A = 400 – 480V AC; B = 500 – 690V AC.
② Drives require three chokes of the designated catalog number with 6-pulse supply.

Table 40-384. Line Reactor Dimensions

Catalog Number	H1 Inches (mm)	W1 Inches (mm)	D1 Inches (mm)	Weight Lbs. (kg)
CHK0023N6A0	7.01 (178)	9.06 (230)	4.76 (121)	22 (10)
CHK0038N6A0	8.23 (209)	10.63 (270)	5.71 (145)	33 (15)
CHK0062N6A0	8.39 (213)	11.81 (300)	6.30 (160)	44 (20)
CHK0087N6A0	9.13 (232)	11.81 (300)	6.69 (170)	57 (26)
CHK0145N6A0	11.50 (292)	11.81 (300)	7.28 (185)	82 (37)
CHK0220N6A0	12.05 (306)	13.86 (352)	7.28 (185)	119 (54)
CHK0325N6A0	13.66 (347)	13.86 (352)	7.28 (185)	132 (60)
CHK0460N6A0	16.54 (423)	13.70 (348)	9.41 (239)	203 (92)
CHK0520N6A0	17.60 (447)	15.51 (394)	10.71 (272)	231 (105)
CHK0590N6A0	20.43 (519)	15.51 (394)	10.71 (272)	276 (125)
CHK0650N6A0	20.51 (521)	15.51 (394)	10.71 (272)	276 (125)
CHK0750N6A0	24.72 (628)	15.51 (394)	11.10 (282)	331 (150)
CHK0820N6A0	24.72 (628)	15.51 (394)	11.10 (282)	331 (150)
CHK1000N6A0	22.68 (576)	19.57 (497)	11.85 (301)	441 (200)
CHK1150N6A0	22.83 (580)	19.57 (497)	11.85 (301)	441 (200)

Dimensions

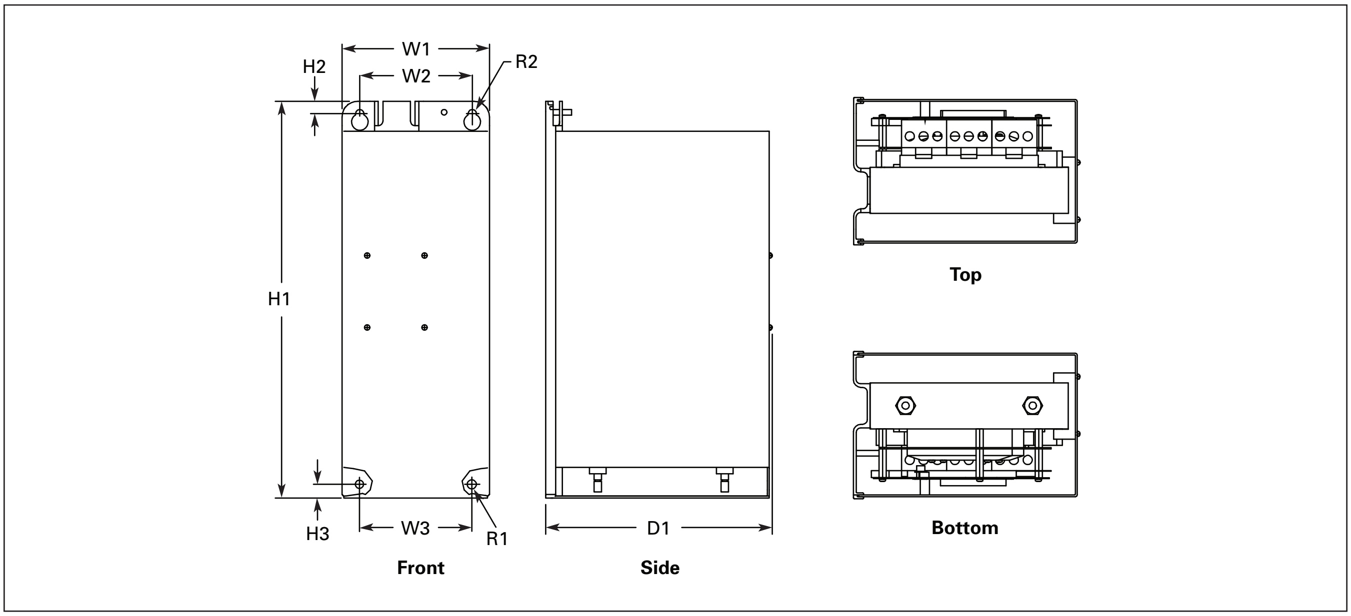


Figure 40-160. Approximate Dimensions, CH3

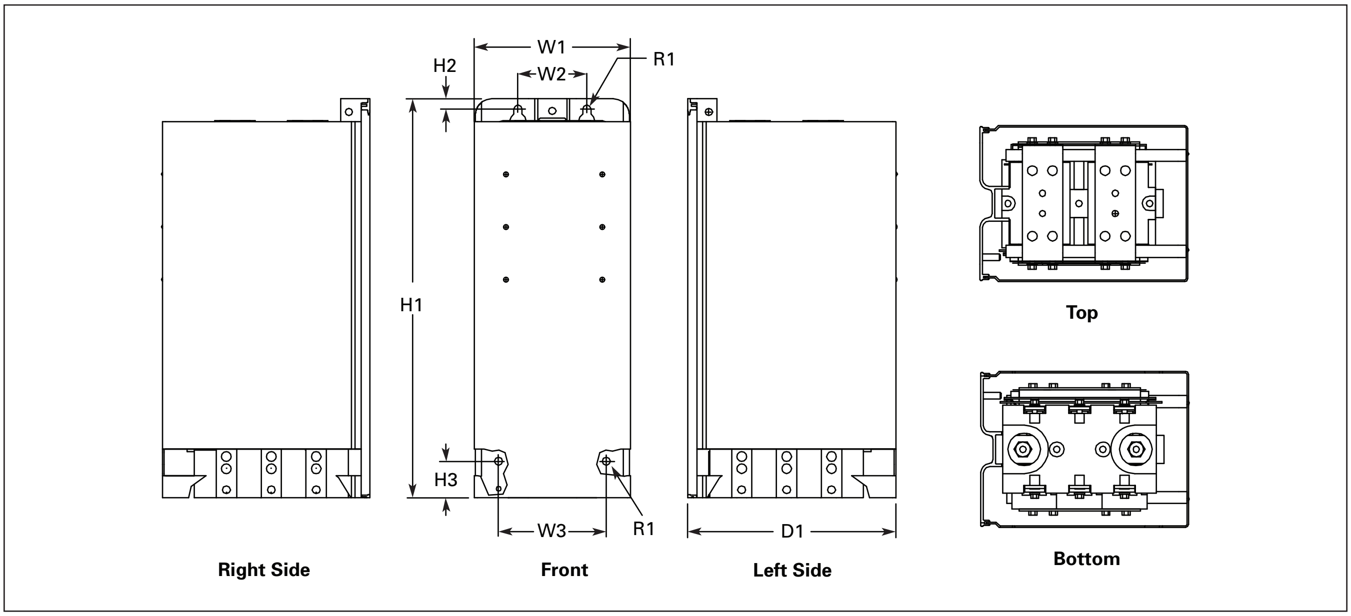


Figure 40-161. Approximate Dimensions, CH4

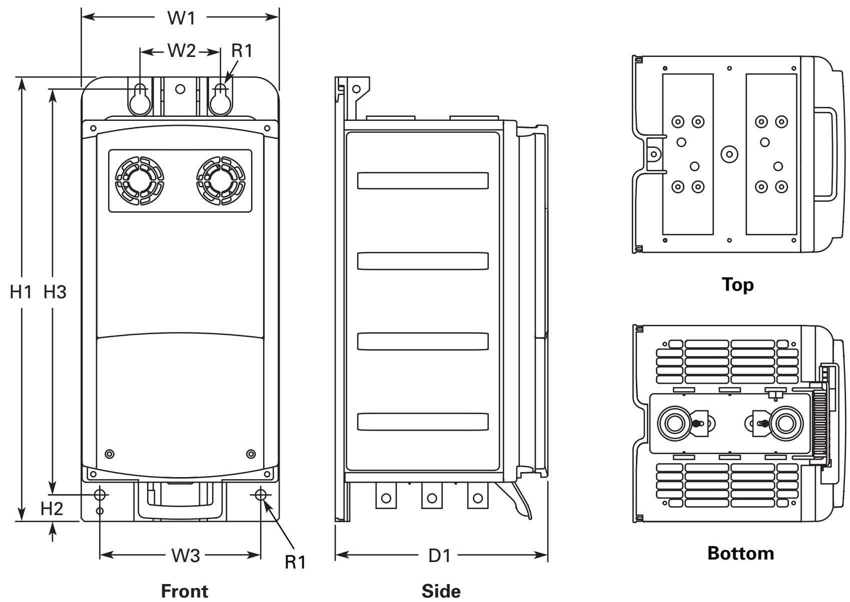


Figure 40-162. Approximate Dimensions, CH5

Table 40-385. LCX9000 Chassis Dimensions

Chassis Size	Voltage	Amps	Approximate Dimensions in Inches (mm)									Weight lbs. (kg)
			H1	H2	H3	D1	W1	W2	W3	R1 dia.	R2 dia.	
CH3	380 – 500V AC	16 – 61	16.97 (431.0)	.53 (13.5)	.59 (15.0)	9.69 (246.0)	6.30 (160.0)	4.80 (122.0)	4.80 (122.0)	.39 (10.0)	.35 (9.0)	66 (30)
CH4	380 – 500V AC	72 – 140	19.41 (493.0)	.49 (12.5)	1.77 (45.0)	10.14 (257.5)	7.60 (193.0)	3.35 (85.0)	5.24 (133.0)	.39 (10.0)	—	77 (35)
CH5	380 – 500V AC	168 – 261	21.77 (553.0)	1.30 (33.0)	19.88 (505.0)	10.39 (264.0)	9.69 (246)	3.94 (100.0)	7.87 (200.0)	.51 (13.0)	—	88 (40)

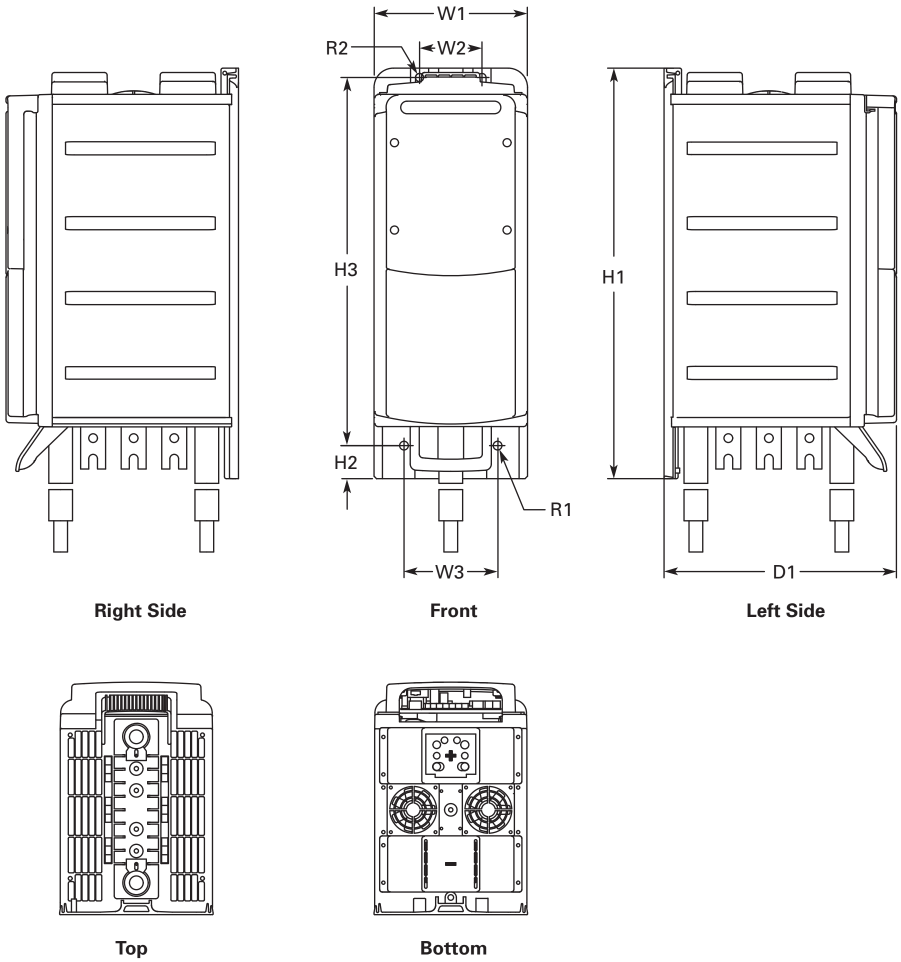


Figure 40-163. Approximate Dimensions, CH61

Table 40-386. LCX9000 Chassis Dimensions

Chassis Size	Voltage	Amps	Approximate Dimensions in Inches (mm)									Weight lbs. (kg)
			H1	H2	H3	D1	W1	W2	W3	R1 dia.	R2 dia.	
CH61	380 – 500V AC	300 – 385	25.91 (658.0)	2.09 (53.0)	23.23 (590.0)	14.69 (373.0)	9.69 (246.0)	3.94 (100.0)	5.91 (150.0)	.55 (14.0)	.51 (13.0)	121 (55)
	525 – 690V AC	170 – 208										

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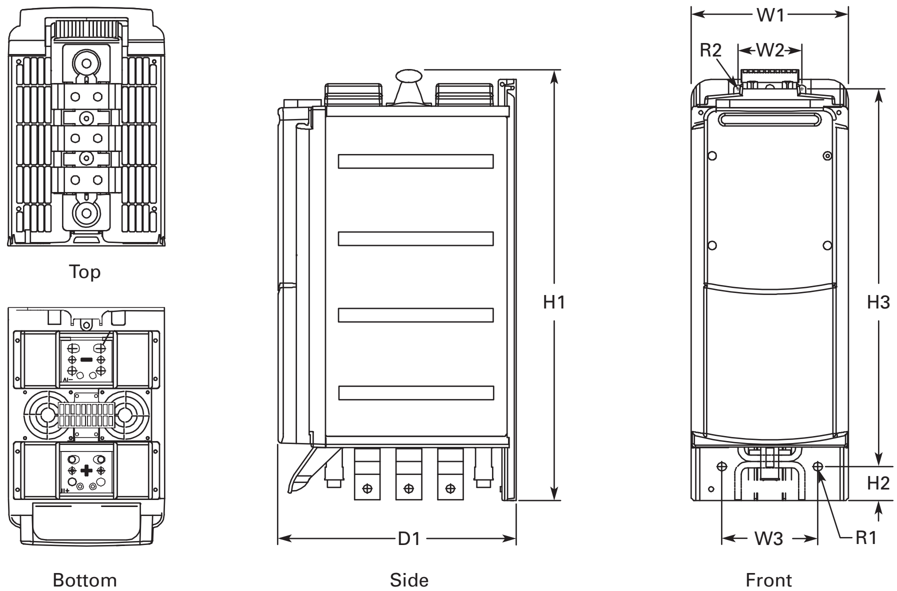


Figure 40-164. Approximate Dimensions, LCX9000 Liquid-Cooled Inverter, CH62

Table 40-387. LCX9000 Liquid-Cooled Inverter, CH62 Dimensions

Chassis Size	Voltage	Amps	Approximate Dimensions in Inches (mm)								
			H1	H2	H3	D1	W1	W2	W3	R1 dia.	R2 dia.
CH62	540 – 675V DC	460 – 730	26.50 (673)	2.0 (53)	23.23 (590)	14.69 (373)	9.69 (246)	3.94 (100)	5.91 (150)	.55 (14)	.51 (13)
	710 – 930V DC	325 – 502									

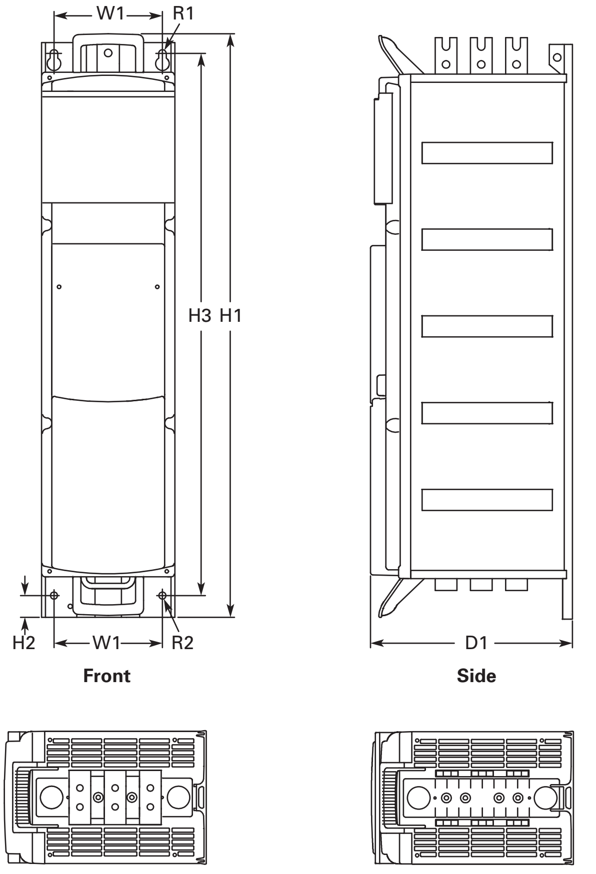


Figure 40-165. Approximate Dimensions, CH72

Table 40-388. LCX9000 Chassis Dimensions

Chassis Size	Voltage	Amps	Approximate Dimensions in Inches (mm)							Weight lbs. (kg)
			H1	H2	H3	D1	W1	R1 dia.	R2 dia.	
CH72	380 – 500V AC	460 – 730	42.38 (1076.5)	1.57 (40.0)	39.37 (1000.0)	14.65 (372.0)	7.87 (200.0)	.55 (14.0)	.51 (13.0)	198 (90)
	525 – 690V AC	261 – 502								

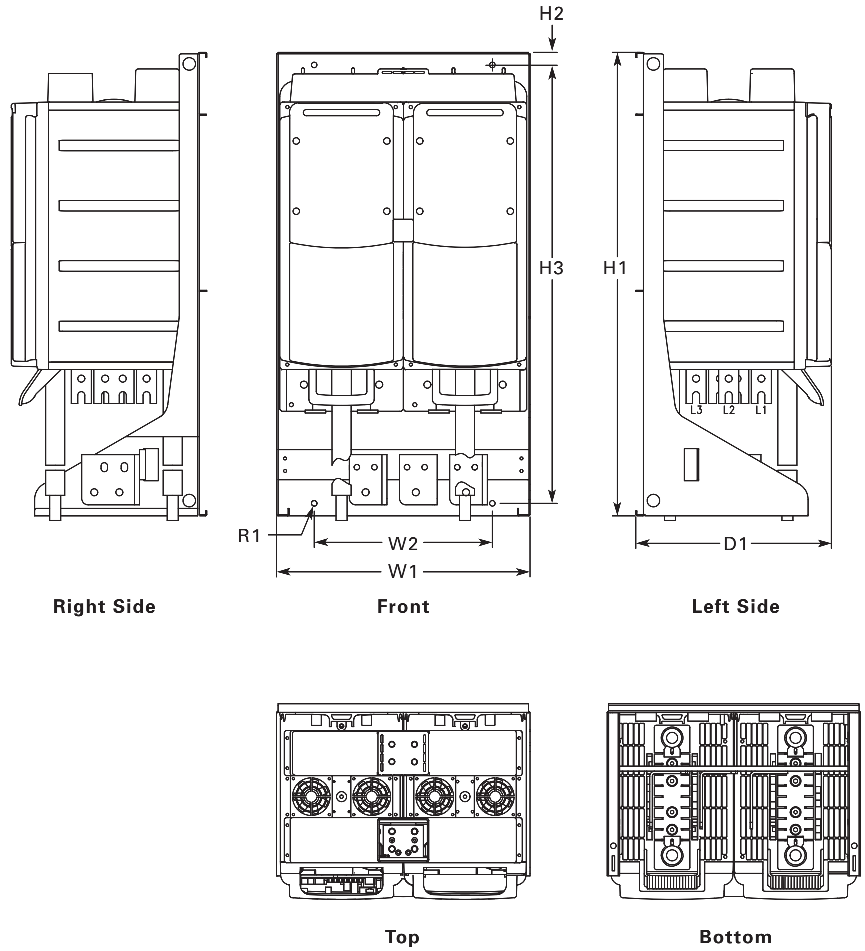


Figure 40-166. Approximate Dimensions, CH63

Table 40-389. LCX9000 Chassis Dimensions

Chassis Size	Voltage	Amps	Approximate Dimensions in Inches (mm)							Weight lbs. (kg)
			H1	H2	H3	D1	W1	W2	R1 dia.	
CH63	380 – 500V AC	820 – 1030	36.36 (923.5)	.91 (23.0)	34.39 (873.5)	15.35 (390.0)	19.88 (505.0)	13.98 (355.0)	.43 (11.0)	264 (120)
	525 – 690V AC	590 – 750								

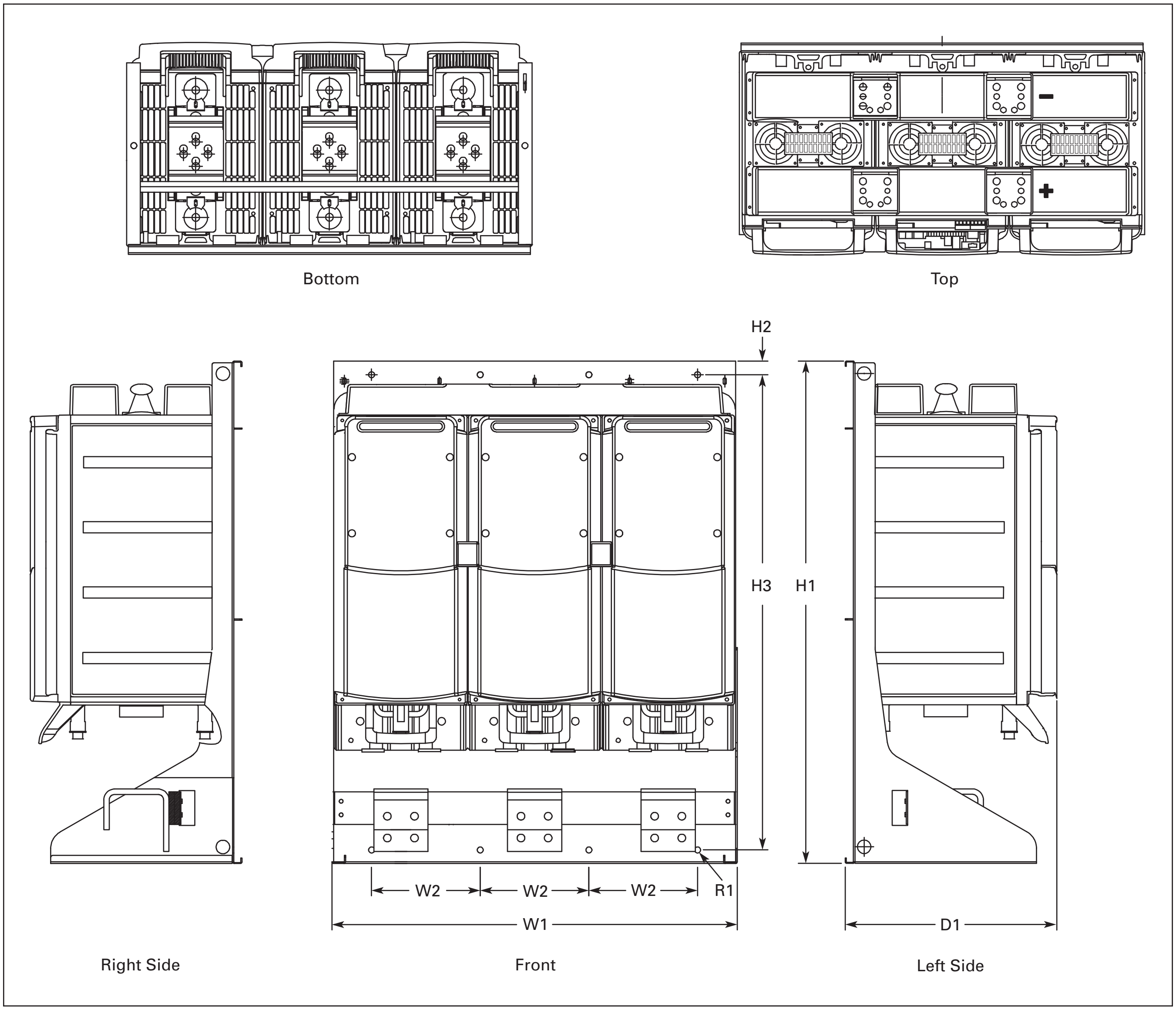


Figure 40-167. Approximate Dimensions, LCX9000 Liquid-Cooled Inverter with Mounting Bracket, CH64, IP90

Table 40-390. LCX9000 Liquid-Cooled Inverter with Mounting Bracket, CH64, IP90 Dimensions

Chassis Size	Voltage	Amps	Approximate Dimensions in Inches (mm)						
			H1	H2	H3	D1	W1	W2	R1 dia.
CH64	540 – 675V DC	1370 – 4140	36.38 (924)	1.03 (26)	34.37 (873)	15.35 (390)	29.37 (746)	7.87 (200)	.43 (11)
	710 – 930V DC	820 – 3100							

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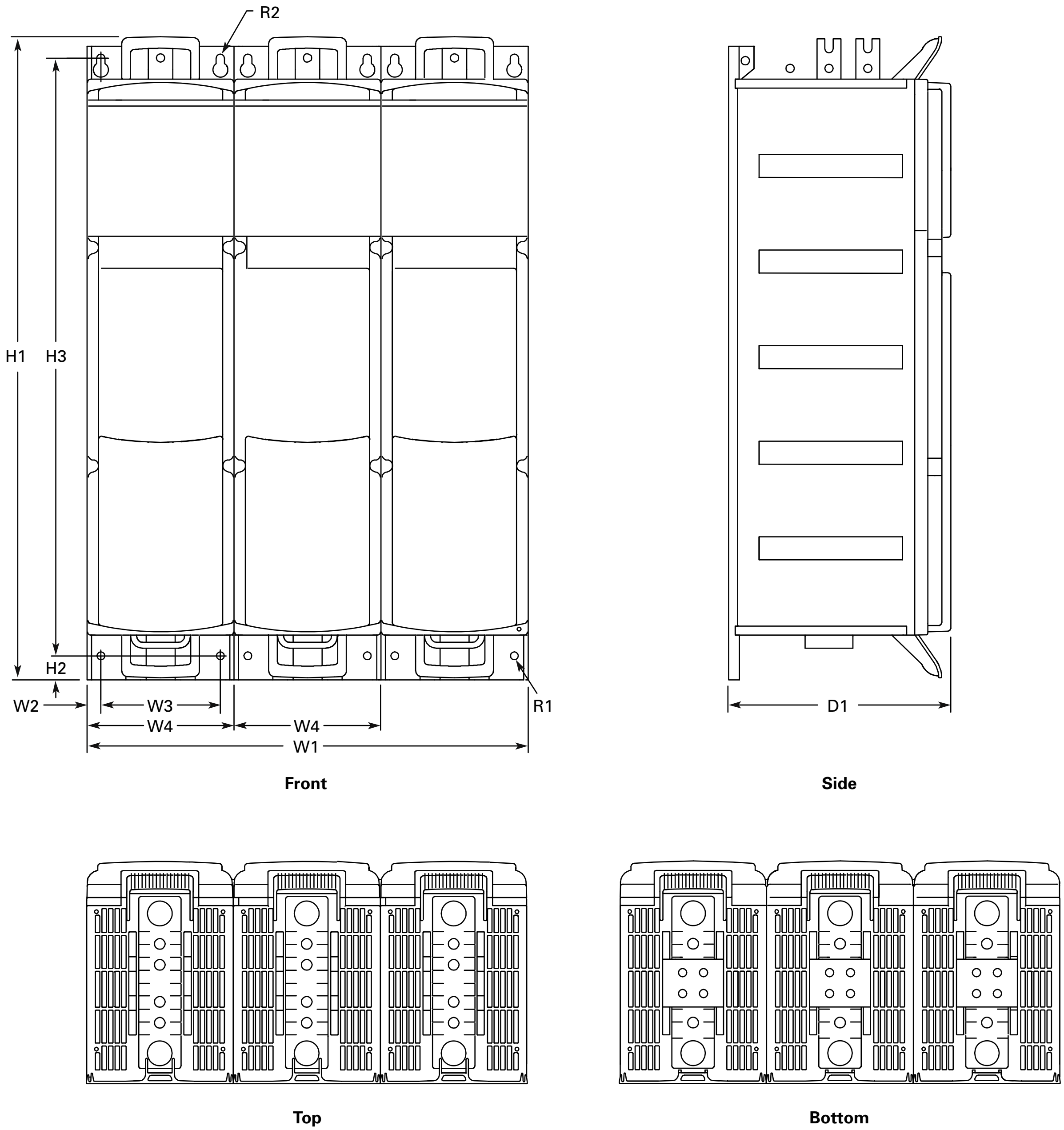


Figure 40-168. Approximate Dimensions, CH74

Table 40-391. LCX9000 Chassis Dimensions

Chassis Size	Voltage	Amps	Approximate Dimensions in Inches (mm)										Weight lbs. (kg)
			H1	H2	H3	D1	W1	W2	W3	W4	R1 dia.	R2 dia.	
CH74	380 – 500V AC	1370 – 2300	42.38 (1076.5)	1.57 (40.0)	39.37 (1000.0)	14.65 (372.0)	29.06 (738.0)	.91 (23.0)	7.87 (200.0)	9.69 (246)	.51 (13.0)	.55 (14.0)	617 (280)
	525 – 690V AC	820 – 1500											

Control Unit Dimensions

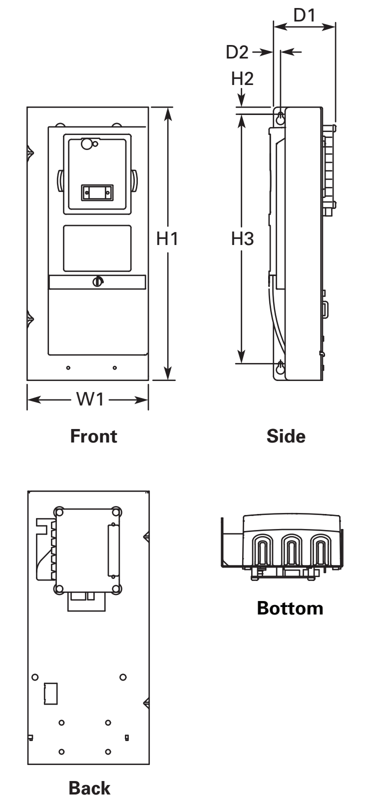


Figure 40-169. Approximate Dimensions, Control Unit

Table 40-392. LCX9000 Control Unit Dimensions

Approximate Dimensions in Inches (mm)					
H1	**H2**	**H3**	**D1**	**D2**	**W1**
12.93 (328.5)	.33 (8.5)	11.81 (300.0)	2.95 (75.0)	.33 (8.5)	5.75 (146.0)

Cooling System Diagrams

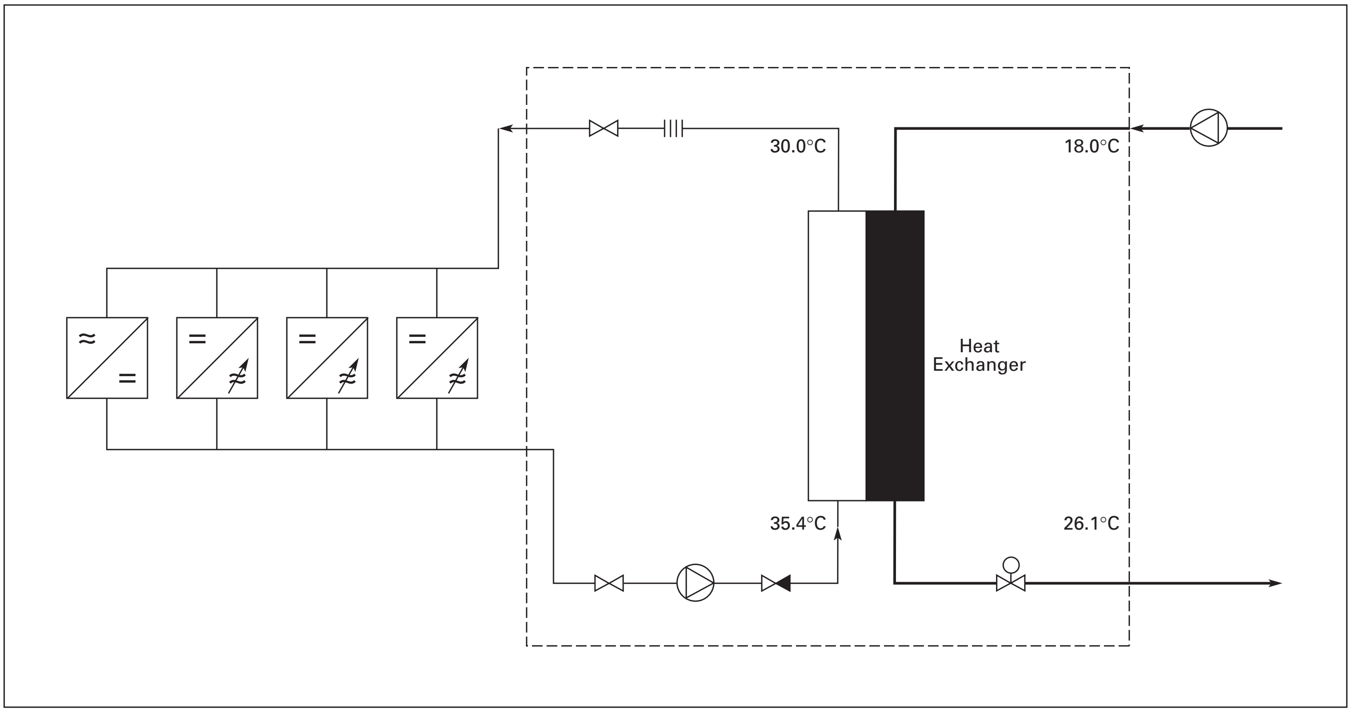


Figure 40-170. Example of a Typical Cooling System

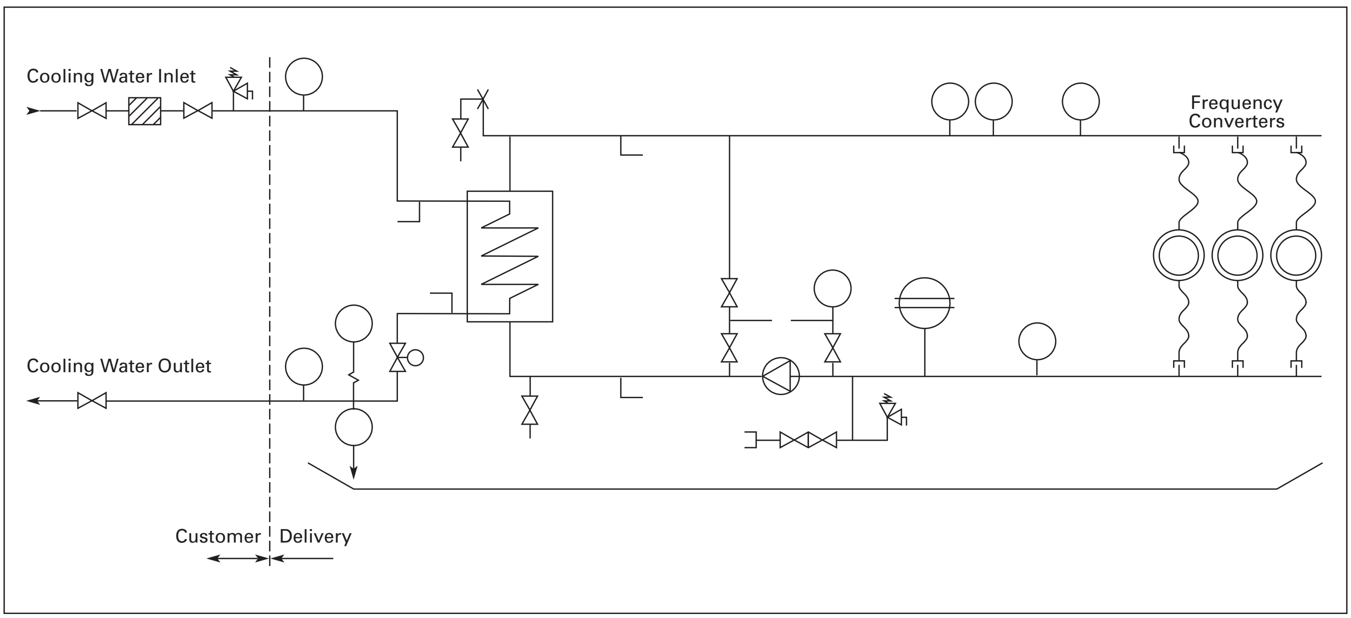


Figure 40-171. Example PI-Diagram of a Typical Cooling System and Connections

I/O Board Wiring Diagrams

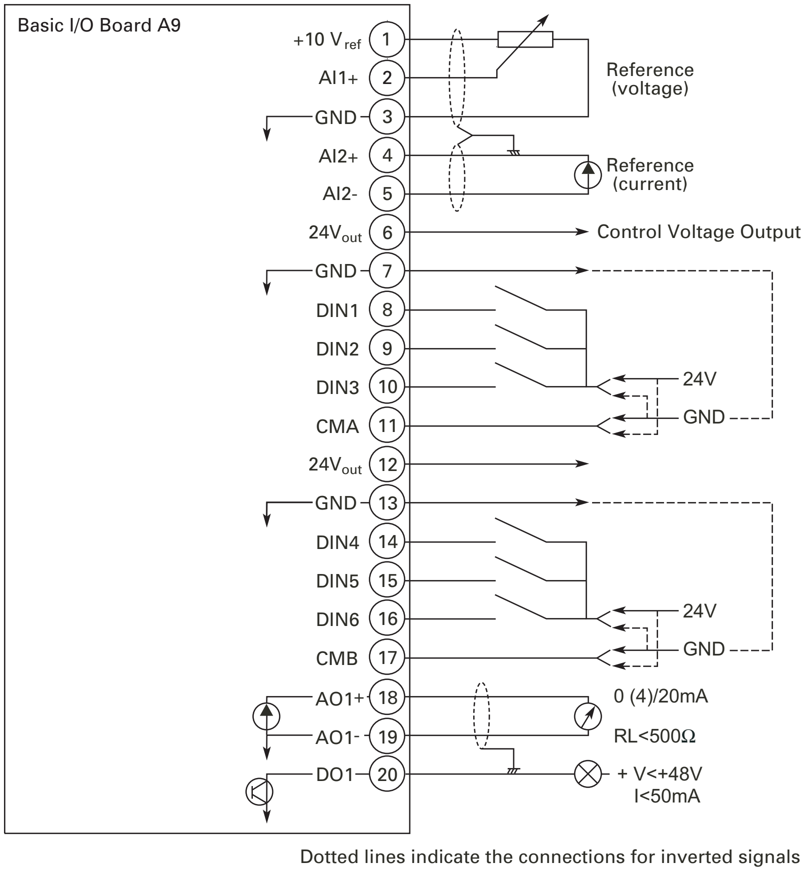


Figure 40-172. A9 Option Board Control Wiring

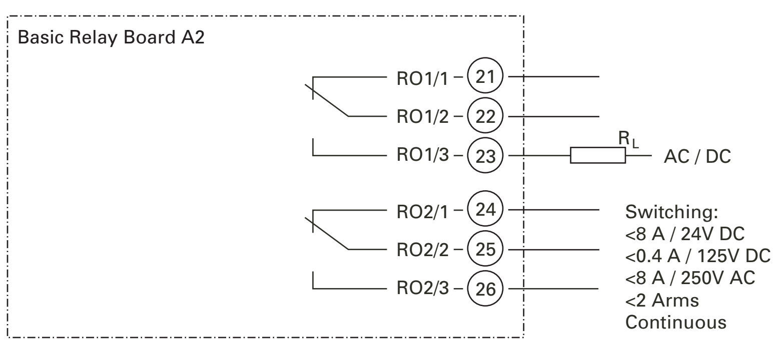


Figure 40-173. A2 Option Board Wiring

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Contents



SPI9000 Products

Product Description

Eaton offers a comprehensive range of Cutler-Hammer® common DC bus drive products. The product family covers a number of front-end units and inverter units in the entire power range from 1-1/2 to 2000 horsepower at 460V and 690V. The drive components are built on the SPX9000 technology.

Front-End Units

The front-end units convert a mains AC voltage and current into a DC voltage and current. The power is transferred from the mains to a common DC bus (and, in certain cases, vice versa).

The SPA (active front-end) unit is a bidirectional (regenerative) power converter for the front end of a common DC bus drive line up. An external LCL filter is used at the input. This unit is suitable in applications where low mains harmonics are required.

The SPN (non-regenerative front-end) unit is a unidirectional (motoring) power converter for the front-end of a common DC bus drive line-up. The device operates as a diode bridge using diode/thyristor components. A dedicated external choke is used at the input. The unit has the capacity to charge a common DC bus. This unit is suitable as a rectifying device when a "normal" level of harmonics is accepted and no regeneration to the mains is required.

Inverter Unit

The SPI9000 Inverter Unit is a bidirectional DC-fed power inverter for the supply and control of AC motors. The inverter is supplied from a common DC bus drive line-up. A charging circuit is needed in case a connection to a live DC bus is required. The DC side charging circuit is integrated up to 75 kW (FR4 – FR8) and external for higher power ratings (FI9 – FI14).

Application Description

The Cutler-Hammer common DC bus product portfolio fulfills all solution demands with a flexible architecture.

Front end units are selected according to the level of harmonics and power requirements. Typical drive system configurations are illustrated in **Figures 40-174 – 40-175**.

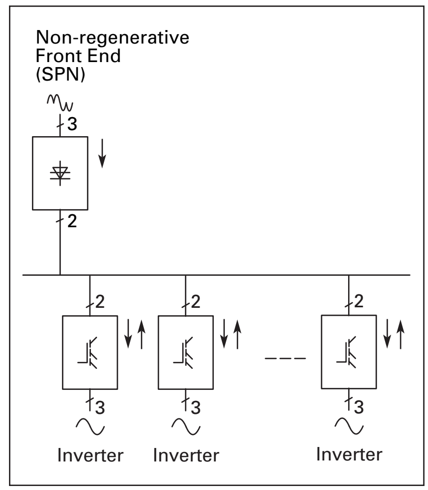


Figure 40-174. SPN + Inverters

- Low total mains power, $P_{mains} \leq \sum P_{INU}$
- Suitable e.g. for small processing line with un- and recoiler, em-stop coasting

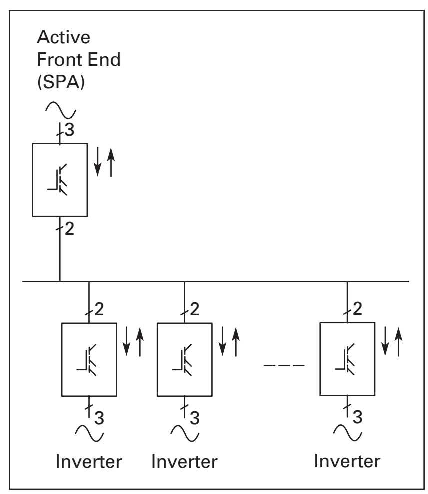


Figure 40-175. SPA + Inverters

- Low harmonics, $-P_{mains} \approx +P_{mains}/P_{mains} \leq \sum P_{INU}$
- Suitable for almost every application

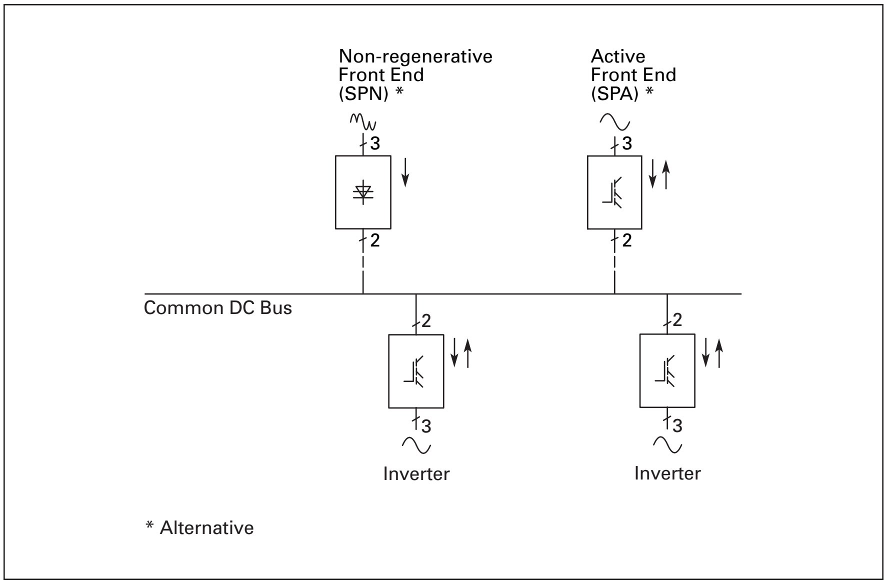


Figure 40-176. Combination Configuration

Common DC bus components are used in a multitude of combinations. Drives which are braking can transfer the energy directly to the drives in motoring mode.

Advantages over Conventional Front Ends

Table 40-393. Cutler-Hammer Front Ends vs. Conventional

	Non-regenerative Front End	**Active Front End**	**Conventional Regenerative Front End** ①
Input device	Choke (L)	Filter (LCL)	Choke or auto-transformer (L)
Bridge type	Diode/thyristor bridge	IGBT bridge, two-level type	Anti-parallel connected thyristor bridge
Type of operation	Controlled half-bridge	High frequency modulation (1.5 to 3.6 kHz)	Firing angle controlled
Direction of power	Motoring	Motoring and regenerating	Motoring and regenerating
Charging	Constant current	External required	Usually internal
DC voltage	Nominal (approx. 1.35 * U_N)	Stable at +10% of nominal (approx. 110% of 1.35 * U_N)	Lowered DC voltage for commutation margin (e.g. 17% fi approx. 83% of 1.35 * U_N) or autotransformer on regenerative bridge
THD	Similar to 6-pulse bridge normal < 40%	Very low	Similar to six-pulse bridge or worse

① Conventional regenerative front end (a.k.a. “anti-parallel thyristor bridge”) is not available from Eaton.

Features and Benefits

Table 40-394. Standard Features

Feature	SPI9000			SPA	SPN
	FR4, 6, 7	FR8	FI9 – FI14	FI9 – FI14	FI9
IP00		●	●	●	●
IP21	●				
Air cooling	●	●	●	●	●
Standard board	●	●	●	●	
Varnished board					●
Alphanumeric keypad	●	●	●	●	
EMC class T (EN 61800-3 for IT networks)	●	●	●	●	●
Safety CE / UL	●	●	●	●	●
Input choke					●
LCL filter				●	
No integrated charging			●	●	
Integrated charging (DC side)	●	●			●
Diode/thyristor rectifier					●
IGBT	●	●	●	●	

Technical Data and Specifications

Table 40-395. Specifications

Description	Specifications
Supply Connection	
Input voltage U_{in} (AC) Front End modules	380 – 500V AC / 525 – 690V AC -10% to +10%
Input voltage U_{in} (DC) Inverter	465 – 800V DC / 640 – 1100V DC -0% to +0%, The waviness of the inverter supply voltage, formed in rectification of the electric network's alternating voltage in basic frequency, must be less than 50V peak-to-peak
Output voltage U_{out} (AC) Inverter	3 ~ 0 – U_{in} / 1.4
Output voltage U_{out} (DC) Active Front End module	1.10 x 1.35 x U_{in} (Factory default)
Output voltage U_{out} (DC) Non-regenerative Front End module	1.35 x U_{in}
Ambient Conditions	
Ambient operating temperature	14 (no frost) to 122°F (-10 to 50°C): I_H 14 (no frost) to 104°F (-10 to 40°C): I_L
Storage temperature	-40 to 158°F (-40 to 70°C)
Relative humidity	0 to 95% RH, non-condensing, non-corrosive, no dripping water
Air quality: – chemical vapors – mechanical particles	 IEC 721-3-3, unit in operation, class 3C2 IEC 721-3-3, unit in operation, class 3S2
Altitude	100% load capacity (no derating) up to 1000m 1% derating for each 100m above 1000m; max. 3000m
Vibration	5 – 150 Hz
EN50178/EN60068-2-6	Displacement amplitude 0.25 mm (peak) at 3 – 15.8 Hz Max acceleration amplitude 1G at 15.8 – 150 Hz
Shock EN50178, EN60068-2-27	UPS Drop Test (for applicable UPS weights) Storage and shipping: max 15G, 11 mS (in package)
Cooling capacity required	approximately 2%
Cooling air required	FR4 41 cfm, FR6 250 cfm, FR7 250 cfm, FR8 383 cfm FI9 677 cfm, FI10 824 cfm, FI12 1648 cfm, FI13 2472 cfm
Unit enclosure class	FR4 – FR7 NEMA Type 1 (IP21); FR8, FI9 – FI14 Chassis (IP00)
EMC (at fault settings)	
Immunity	Fulfill all EMC immunity requirements
Safety	
Approvals	CE, UL, CUL, EN 61800-5-1 (2003), see unit nameplate for more detailed approvals
Control Connections	
Analog input voltage	0 – 10V, R_i = 200 kΩ, (-10V – 10V joystick control) Resolution 0.1%, accuracy ±1%
Analog input current	0(4) – 20 mA, R_i = 250Ω differential
Digital inputs	6, positive or negative logic; 18 – 30V DC

Table 40-395. Specifications (Continued)

Description	Specifications
Control Connections (Continued)	
Auxiliary voltage	+24V, ±15%, max. 250 mA
Output reference voltage	+10V, +3%, max. load 10 mA
Analog output	0(4) – 20 mA; RL max. 500Ω; resolution 10 bits Accuracy ±2%
Digital outputs	Open collector output, 50 mA / 48V
Relay outputs	2 programmable change-over relay outputs Switching capacity: 24V DC / 8A, 250V AC / 8A, 125V DC / 0.4A Min. switching load: 5V / 10 mA
Protections	
Overvoltage protection	480V / 911V DC, 575V / 1200V DC
Undervoltage protection	480V / 333V DC, 575V / 460V DC
Ground fault protection	In case of ground fault in motor or motor cable, only the inverter is protected
Motor phase supervision	Trips if any of the output phases is missing
Overcurrent protection	Yes
Unit overtemperature protection	Yes
Motor overload protection	Yes
Motor stall protection	Yes
Motor underload protection	Yes
Short circuit protection of 24V and 10V reference voltages	Yes

Table 40-396. Input Fuses

Module		Bussman Fuse Type (aR)	Size	U_N (V)	I_N (A)	Qty.
Component	Frame					
Inverter Units						
SPI003A1-4	FR4	170M1560	000	690	20	2
SPI007A1-4	FR4	170M1562	000	690	63	2
SPI009A1-4	FR4	170M1562	000	690	63	2
SPI012A1-4	FR6	170M1565	000	690	63	2
SPI016A1-4	FR6	170M1565	000	690	63	2
SPI023A1-4	FR6	170M1565	000	690	63	2
SPI031A1-4	FR6	170M1567	000	690	100	2
SPI038A1-4	FR6	170M1567	000	690	100	2
SPI061A1-4	FR7	170M1570	000	690	200	2
SPI072A1-4	FR7	170M1570	000	690	200	2
SPI087A1-4	FR7	170M1571	000	690	250	2
SPI105A0-4	FR8	170M3819	DIN1	690	400	2
SPI140A0-4	FR8	170M3819	DIN1	690	400	2
SPI170A0-4	FR8	170M3819	DIN1	690	400	2
SPI205A0-4	FI9	170M6812	DIN3	690	800	2
SPI245A0-4	FI9	170M6812	DIN3	690	800	2
SPI300A0-4	FI10	170M8547	3SHT	690	1250	2
SPI385A0-4	FI10	170M8547	3SHT	690	1250	2
SPI460A0-4	FI10	170M8547	3SHT	690	1250	2
SPI520A0-4	FI12	170M8547	3SHT	690	1250	2 x 2
SPI590A0-4	FI12	170M8547	3SHT	690	1250	2 x 2
SPI650A0-4	FI12	170M8547	3SHT	690	1250	2 x 2
SPI730A0-4	FI12	170M8547	3SHT	690	1250	2 x 2
SPI820A0-4	FI12	170M8547	3SHT	690	1250	2 x 2
SPI920A0-4	FI12	170M8547	3SHT	690	1250	2 x 2
SPIH10A0-4	FI13	170M8547	3SHT	690	1250	6
SPIH11A0-4	FI13	170M8547	3SHT	690	1250	6
SPIH13A0-4	FI13	170M8547	3SHT	690	1250	6
SPIH16A0-4	FI14	170M8547	3SHT	690	1250	2 x 6
SPIH19A0-4	FI14	170M8547	3SHT	690	1250	2 x 6
SPIH23A0-4	FI14	170M8547	3SHT	690	1250	2 x 6
Active Front Ends						
SPA205A0-4	FI9	170M6202	3SHT	1250	500	3
SPA385A0-4	FI10	170M6277	3SHT	1250	1000	3
SPAH10A0-4	FI13	170M6277	3SHT	1250	1000	3 x 3
Non-regenerative Front Ends						
SPN468A0-4	FI9	170M8547	3SHT	690	1250	3

Note: SHT fuses can be assembled into same-size DIN fuse base.

Catalog Number Selection

Table 40-397. Active Front End Catalog Numbering System

S P A 2 0 5 A 0 – 4 A 3 N 1

Product Family
SPA = Active Front End

Current Rating	
480V	**575V**
205 = 205A	**125** = 125A
385 = 385A	**325** = 325A
H10 = 1150A	**920** = 920A

Software Series
A = Standard

Enclosure Rating
0 = Chassis

Voltage Rating
4 = 480V
5 = 575V

Keypad
A = Alphanumeric

EMC Level
3 = IT Network

Brake Chopper Options
N = No Brake Chopper Circuit

Board Modifications
1 = Standard Boards
2 = Varnished Boards

Table 40-398. Non-regenerative Front End Catalog Numbering System

S P N 5 1 0 A 0 – 4 A 3 N 1

Product Family
SPN = Non-regenerative Front End

Current Rating
480V/575V
510 = 510A

Software Series
A = Standard

Enclosure Rating
0 = Chassis

Voltage Rating
4 = 480V
5 = 575V

Keypad
A = Alphanumeric

EMC Level
3 = IT Network

Brake Chopper Options
N = No Brake Chopper Circuit

Board Modifications
1 = Standard Boards
2 = Varnished Boards

Table 40-399. SPI9000 Inverter Unit Catalog Numbering System

S P I 0 1 6 A 1 – 4 A 3 N 1

Product Family
SPI = Inverter Unit

Current Rating

480V (FR4 – FR8)		575V (FR6 – FR8)	
003 = 3.3A	**031** = 31A	**003** = 3.2A	**022** = 22A
007 = 7.6A	**038** = 38A	**004** = 4.5A	**027** = 27A
009 = 9A	**061** = 61A	**005** = 5.5A	**034** = 34A
012 = 12A	**071** = 72A	**007** = 7.5A	**041** = 41A
016 = 16A	**087** = 87A	**010** = 10A	**052** = 52A
023 = 23A	**105** = 105A	**013** = 13.5A	**062** = 62A
		018 = 18A	**080** = 80A

480V (FI9 – FI13)		575V (FI9 – FI14)	
140 = 140A	**730** = 730A	**100** = 100A	**502** = 502A
170 = 170A	**820** = 820A	**125** = 125A	**590** = 590A
205 = 205A	**920** = 920A	**144** = 144A	**650** = 650A
245 = 245A	**H10** = 1030A	**170** = 170A	**820** = 820A
300 = 300A	**H11** = 1150A	**208** = 207A	**920** = 920A
385 = 385A	**H13** = 1300A	**261** = 261A	**H10** = 1030A
460 = 460A	**H16** = 1600A	**325** = 325A	**H13** = 1300A
520 = 520A	**H19** = 1940A	**385** = 385A	**H15** = 1500A
590 = 590A	**H23** = 2300A	**460** = 460A	**H19** = 1900A
650 = 650A			

Software Series
A = Standard

Enclosure Rating
1 = Type 1
0 = Chassis

Voltage Rating
4 = 480V
5 = 575V

Keypad
A = Alphanumeric

EMC Level
3 = IT Network

Brake Chopper Options
N = No Brake Chopper Circuit

Board Modifications
1 = Standard Boards
2 = Varnished Boards

Product Selection

Table 40-400. Active Front End 480V Product Selection

Frame	Low Overload (AC Current)		High Overload (AC Current)		Imax	Catalog Number	Price U.S. $
	$I_{L\text{-}cont}$ (A)	I_{1min} (A)	$I_{H\text{-}cont}$ (A)	I_{1min} (A)	I_{2s} (A)		
FI9	261	287	205	308	349	**SPA205A0-4A3N1**	
FI10	460	506	385	578	693	**SPA385A0-4A3N1**	
FI13	1300	1430	1150	1725	2070	**SPAH11A0-4A3N1**	

Table 40-401. Non-regenerative Front End 480V Product Selection

Frame	Low Overload (AC Current)		High Overload (AC Current)		Imax	Catalog Number	Price U.S. $
	$I_{L\text{-}cont}$ (A)	I_{1min} (A)	$I_{H\text{-}cont}$ (A)	I_{1min} (A)	I_{2s} (A)		
FI9	520	572	460	690	828	**SPN460A0-4A3N1**	

Table 40-402. SPI9000 Inverter Unit 480V Product Selection

Frame	Low Overload (AC Current)		High Overload (AC Current)		Imax	Catalog Number	Price U.S. $
	$I_{L\text{-}cont}$ (A)	I_{1min} (A)	$I_{H\text{-}cont}$ (A)	I_{1min} (A)	I_{2s} (A)		
FR4	4.3	4.7	3.3	5.0	6.2	**SPI003A1-4A3N1**	
FR4	9	9.9	7.6	11.4	14	**SPI007A1-4A3N1**	
FR4	12	13.2	9	13.5	18	**SPI009A1-4A3N1**	
FR6	16	17.6	12	18	24	**SPI012A1-4A3N1**	
FR6	23	25.3	16	24	32	**SPI016A1-4A3N1**	
FR6	31	34	23	35	46	**SPI023A1-4A3N1**	
FR6	38	42	31	47	62	**SPI031A1-4A3N1**	
FR6	46	51	38	57	76	**SPI038A1-4A3N1**	
FR7	72	79	61	92	122	**SPI061A1-4A3N1**	
FR7	87	96	72	108	144	**SPI072A1-4A3N1**	
FR7	105	116	87	131	174	**SPI087A1-4A3N1**	
FR8	140	154	105	158	210	**SPI105A0-4A3N1**	
FI9	170	187	140	210	280	**SPI140A0-4A3N1**	
FI9	205	226	170	255	336	**SPI170A0-4A3N1**	
FI9	261	287	205	308	349	**SPI205A0-4A3N1**	
FI9	300	330	245	379	444	**SPI245A0-4A3N1**	
FI10	385	424	300	450	540	**SPI300A0-4A3N1**	
FI10	460	506	385	578	693	**SPI385A0-4A3N1**	
FI10	520	572	460	690	828	**SPI460A0-4A3N1**	
FI12	590	649	520	780	936	**SPI520A0-4A3N1**	
FI12	650	715	590	885	1062	**SPI590A0-4A3N1**	
FI12	730	803	650	975	1170	**SPI650A0-4A3N1**	
FI12	820	902	730	1095	1314	**SPI730A0-4A3N1**	
FI12	920	1012	820	1230	1476	**SPI820A0-4A3N1**	
FI12	1030	1133	920	1380	1656	**SPI920A0-4A3N1**	
FI13	1150	1265	1030	1545	1854	**SPIH10A0-4A3N1**	
FI13	1300	1430	1150	1720	2070	**SPIH11A0-4A3N1**	
FI13	1450	1595	1300	1950	2340	**SPIH13A0-4A3N1**	
FI14	1770	1947	1600	2400	2880	**SPIH16A0-4A3N1**	
FI14	2150	2365	1940	2910	3492	**SPIH19A0-4A3N1**	

Table 40-403. LCL Filters for Active Front End (480V)

Catalog Number	Amps	Price U.S. $
REG 10 5 0	10	
REG 18 5 0	18	
REG 32 5 0	32	
REG 48 5 0	48	
REG 75 5 0	75	
REG 110 5 0	110	
REG 180 5 0	180	
REG 270 5 0	270	
REG 410 5 0	410	
REG 580 5 0	580	
REG 840 5 0	840	
REG 1160 5 0	1160	
REG 1480 5 0	1480	

Table 40-404. Line Reactor for Non-regenerative Front End (480/575V)

Catalog Number	Amps	Watts Losses	Price U.S. $
CHK600	600	493	

Discount Symbol **SS-2**

Table 40-405. Active Front End 575V Product Selection

Frame	Low Overload (AC Current)		High Overload (AC Current)		Imax	Catalog Number	Price U.S. $
	$I_{L\text{-}cont}$ (A)	I_{1min} (A)	$I_{H\text{-}cont}$ (A)	I_{1min} (A)	I_{2s} (A)		
FI9	144	158	125	188	213	**SPA125A0-5A3N1**	
FI10	385	424	325	488	585	**SPA325A0-5A3N1**	
FI13	1030	1133	920	1380	1656	**SPA920A0-5A3N1**	

Table 40-406. Non-regenerative Front End 575V Product Selection

Frame	Low Overload (AC Current)		High Overload (AC Current)		Imax	Catalog Number	Price U.S. $
	$I_{L\text{-}cont}$ (A)	I_{1min} (A)	$I_{H\text{-}cont}$ (A)	I_{1min} (A)	I_{2s} (A)		
FI9	600	660	510	732	888	**SPN510A0-5A3N1**	

Table 40-407. SPI9000 Inverter Unit 575V Product Selection

Frame	Low Overload (AC Current)		High Overload (AC Current)		Imax	Catalog Number	Price U.S. $
	$I_{L\text{-}cont}$ (A)	I_{1min} (A)	$I_{H\text{-}cont}$ (A)	I_{1min} (A)	I_{2s} (A)		
FR6	4.5	5	3.2	5	6.4	**SPI003A1-5A3N1**	
FR6	5.5	6	4.5	7	9	**SPI004A1-5A3N1**	
FR6	7.5	8	5.5	8	11	**SPI005A1-5A3N1**	
FR6	10	11	7.5	11	15	**SPI007A1-5A3N1**	
FR6	13.5	15	10	15	20	**SPI010A1-5A3N1**	
FR6	18	20	13.5	20	27	**SPI013A1-5A3N1**	
FR6	22	24	18	27	36	**SPI018A1-5A3N1**	
FR6	27	30	22	33	44	**SPI022A1-5A3N1**	
FR6	34	37	27	41	54	**SPI027A1-5A3N1**	
FR7	41	45	34	51	68	**SPI034A1-5A3N1**	
FR7	52	57	41	62	82	**SPI041A1-5A3N1**	
FR8	62	68	52	78	104	**SPI052A0-5A3N1**	
FR8	80	88	62	93	124	**SPI062A0-5A3N1**	
FR8	100	110	80	120	160	**SPI080A0-5A3N1**	
FI9	125	138	100	150	200	**SPI100A0-5A3N1**	
FI9	144	158	125	188	213	**SPI125A0-5A3N1**	
FI9	170	187	144	216	245	**SPI144A0-5A3N1**	
FI9	208	229	170	255	289	**SPI170A0-5A3N1**	
FI10	261	287	208	312	375	**SPI208A0-5A3N1**	
FI10	325	358	261	392	470	**SPI261A0-5A3N1**	
FI10	385	424	325	488	585	**SPI325A0-5A3N1**	
FI12	460	506	385	578	693	**SPI385A0-5A3N1**	
FI12	502	552	460	690	828	**SPI460A0-5A3N1**	
FI12	590	649	502	753	904	**SPI502A0-5A3N1**	
FI12	650	715	590	885	1062	**SPI590A0-5A3N1**	
FI12	750	825	650	975	1170	**SPI650A0-5A3N1**	
FI13	920	1012	820	1230	1476	**SPI820A0-5A3N1**	
FI13	1030	1133	920	1380	1656	**SPI920A0-5A3N1**	
FI13	1180	1298	1030	1464	1755	**SPIH10A0-5A3N1**	
FI14	1500	1650	1300	1950	2340	**SPIH13A0-5A3N1**	
FI14	1900	2090	1500	2250	2700	**SPIH15A0-5A3N1**	
FI14	2250	2475	1900	2782	3335	**SPIH19A0-5A3N1**	

Table 40-408. LCL Filters for Active Front End (690V)

Catalog Number	Amps	Price U.S. $
REG 14 6 0	14	
REG 23 6 0	23	
REG 35 6 0	35	
REG 52 6 0	52	
REG 85 6 0	85	
REG 122 6 0	122	
REG 185 6 0	185	
REG 287 6 0	287	
REG 390 6 0	390	
REG 460 6 0	460	
REG 620 6 0	620	
REG 780 6 0	780	
REG 920 6 0	920	
REG 1180 6 0	1180	

Table 40-409. Line Reactor for Non-regenerative Front End (480/575V)

Catalog Number	Amps	Watts Losses	Price U.S. $
CHK600	600	493	

Discount Symbol **SS-2**

June 2008

Series Option Board Kits

The 9000X Series drives can accommodate a wide selection of expander and adapter option boards to customize the drive for your application needs. The drive's control unit is designed to accept a total of five option boards (see **Figure 40-177**).

The 9000X Series factory installed standard board configuration includes an A9 I/O board and an A2 relay output board, which are installed in slots A and B.

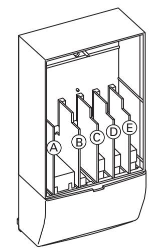


Figure 40-177. 9000X Series Option Boards

Table 40-410. Option Board Kits

Option Kit Description ②	Allowed Slot Locations ①	Field Installed		Factory Installed		SVX Ready Programs						
		Catalog Number	Price U.S.$	Option Designator	Adder U.S.$	Basic	Local/ Remote	Standard	MSS	PID	Multi-P.	PFC
Standard I/O Cards (See Figure 40-177)												
2 RO (NC/NO)	B	**OPTA2**		**—**		X	X	X	X	X	X	X
6 DI, 1 DO, 2 AI, 1AO, 1 +10V DC ref, 2 ext +24V DC/ EXT +24V DC	A	**OPTA9**		**—**		X	X	X	X	X	X	X
Extended I/O Card Options												
2 RO, Therm	B	**OPTA3**		**A3**		—	X	X	X	X	X	X
Encoder low volt +5V/15V24V	C	**OPTA4**		**A4**		—	X	X	X	X	X	X
Encoder high volt +15V/24V	C	**OPTA5**		**A5**		—	X	X	X	X	X	X
Double encoder	C	**OPTA7**		**A7**		X	X	X	X	X	X	X
6 DI, 1 DO, 2 AI, 1 AO	A	**OPTA8**		**A8**		—	X	X	X	X	X	X
3 DI (Encoder 10 – 24V), Out +15V/+24V, 2 DO (pulse+direction)	C	**OPTAE**		**AE**		X	X	X	X	X	X	X
6 DI, 1 ext +24V DC/EXT +24V DC	B, C, **D**, E	**OPTB1**		**B1**		—	—	—	—	—	X	X
1 RO (NC/NO), 1 RO (NO), 1 Therm	B, C, **D**, E	**OPTB2**		**B2**		—	—	—	—	—	X	X
1 AI (mA isolated), 2 AO (mA isolated), 1 ext +24V DC/EXT +24V DC	B, C, **D**, E	**OPTB4**		**B4**		—	X	X	X	X	X	X
3 RO (NO)	B, C, **D**, E	**OPTB5**		**B5**		—	—	—	—	—	X	X
1 ext +24V DC/EXT +24V DC, 3 Pt100	B, C, **D**, E	**OPTB8**		**B8**		—	—	—	—	—	—	—
1 RO (NO), 5 DI 42 – 240V AC Input	B,C, **D**, E	**OPTB9**		**B9**		—	—	—	—	—	X	X
SPI, Absolute Encoder	C	**OPTBB**		**BB**		—	—	—	—	—	—	—
Communication Cards ③												
Modbus	D, **E**	**OPTC2**		**C2**		X	X	X	X	X	X	X
Johnson Controls N2	D, **E**	**OPTC2**		**CA**		—	—	—	—	—	—	—
Modbus TCP	D, **E**	**OPTCI**		**CI**		X	X	X	X	X	X	X
BACnet	D, **E**	**OPTCJ**		**CJ**		X	X	X	X	X	X	X
Ethernet IP	D, **E**	**OPTCK**		**CK**		X	X	X	X	X	X	X
Profibus DP	D, **E**	**OPTC3**		**C3**		X	X	X	X	X	X	X
LonWorks	D, **E**	**OPTC4**		**C4**		X	X	X	X	X	X	X
Profibus DP (D9 Connector)	D, **E**	**OPTC5**		**C5**		X	X	X	X	X	X	X
CanOpen (Slave)	D, **E**	**OPTC6**		**C6**		X	X	X	X	X	X	X
DeviceNet	D, **E**	**OPTC7**		**C7**		X	X	X	X	X	X	X
Modbus (D9 Type Connector)	D, **E**	**OPTC8**		**C8**		X	X	X	X	X	X	X
Adapter	D, **E**	**OPTD1**		**D1**		X	X	X	X	X	X	X
Adapter	D, **E**	**OPTD2**		**D2**		X	X	X	X	X	X	X
RS-232 with D9 Connection	D, **E**	**OPTD3**		**D3**		X	X	X	X	X	X	X
Keypad												
9000X Series Local/ Remote Keypad (Replacement Keypad)	—	**KEYPAD-LOC/REM**		**—**		—	—	—	—	—	—	X
9000X Series Remote Mount Keypad Unit (Keypad not included, includes 10 ft. cable, keypad holder, mounting hardware)	—	**OPTRMT-KIT-9000X**		**—**		—	—	—	—	—	—	—
9000X Series RS-232 Cable, 13 ft.	—	**PP00104**		**—**		—	—	—	—	—	—	—

① Option card must be installed in one of the slots listed for that card. Slot indicated in Bold is the preferred location.
② AI = Analog Input; AO = Analog Output, DI = Digital Input, DO = Digital Output, RO = Relay Output
③ OPTC2 is a multi-protocol option card.

Discount Symbol **SS-2**

Dimensions

Table 40-411. Approximate Dimensions in Inches (mm)

Frame	Height	Width	Depth	Weight in Lbs. (kg)
Inverter Units				
FR4	11.5 (292)	5.0 (128)	7.5 (190)	11 (5)
FR6	20.4 (519)	7.7 (195)	9.3 (237)	35 (16)
FR7	23.3 (591)	9.3 (237)	10.1 (257)	64 (29)
FR8	29.8 (758)	11.4 (289)	13.5 (344)	106 (48)
FI9	40.6 (1030)	9.4 (239)	14.6 (372)	148 (67)
FI10	40.6 (1032)	9.4 (239)	21.7 (552)	220 (100)
FI12	40.6 (1032)	2 x 9.4 (2 x 239)	21.7 (552)	441 (200)
FI13	40.6 (1032)	27.9 (708)	21.8 (553)	674 (306)
FI14	40.6 (1032)	2 x 27.9 (2 x 708)	21.8 (553)	1348 (612)
Active Front Ends				
FI9	40.6 (1030)	9.4 (239)	14.6 (372)	148 (67)
FI10	40.6 (1032)	9.4 (239)	21.7 (552)	220 (100)
FI12	40.6 (1032)	2 x 9.4 (2 x 239)	21.7 (552)	441 (200)
FI13	40.6 (1032)	27.9 (708)	21.8 (553)	674 (306)
FI14	40.6 (1032)	2 x 27.9 (2 x 708)	21.8 (553)	1348 (612)
Non-regenerative Front Ends				
FI9	40.6 (1030)	9.4 (239)	14.6 (372)	148 (67)

Wiring Diagrams

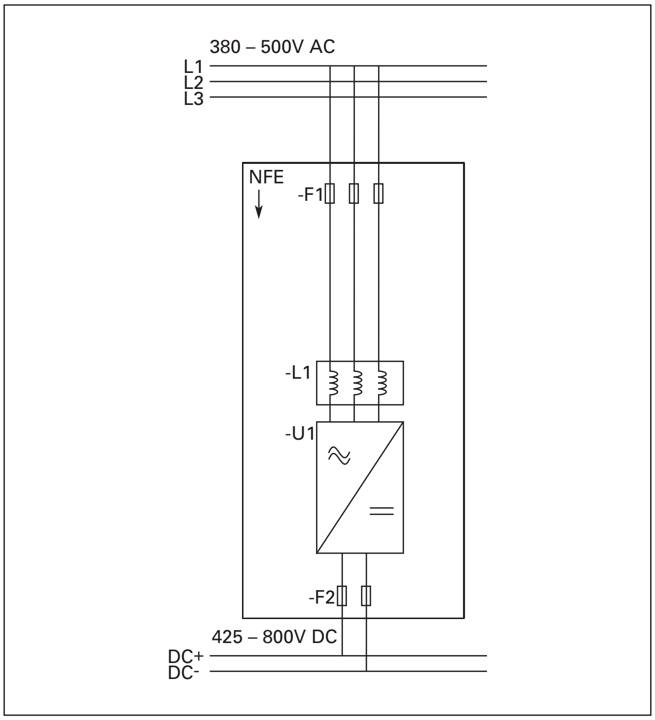


Figure 40-178. Non-regenerative Front End

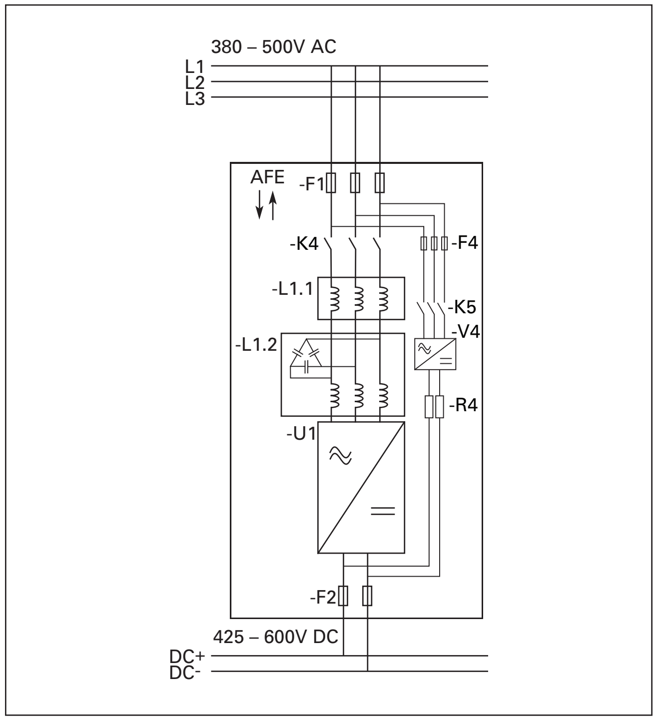


Figure 40-180. Active Front End

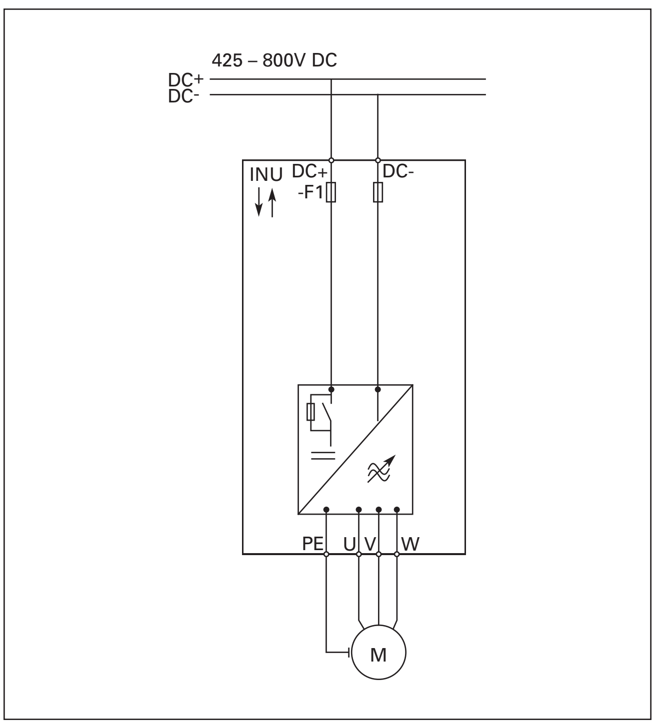


Figure 40-179. Inverter Unit (FR4 – FR8)

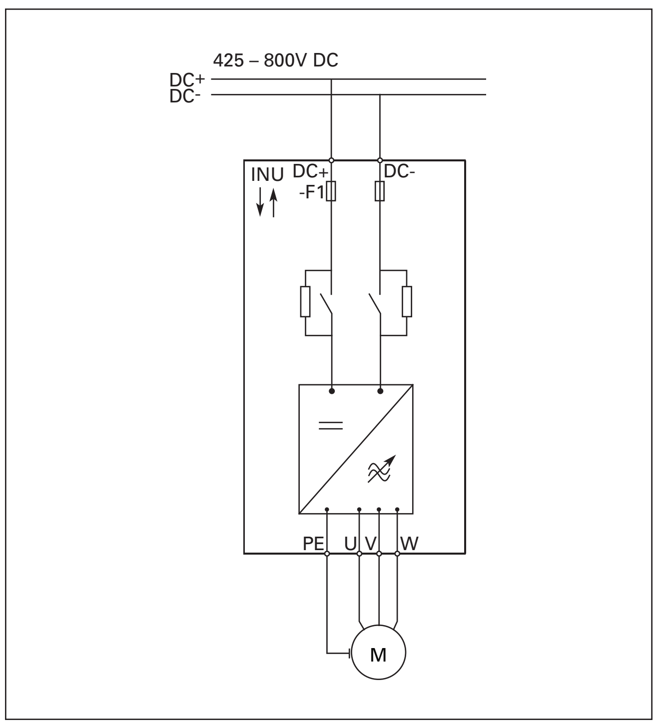


Figure 40-181. Inverter Unit (FI9 – FI14)